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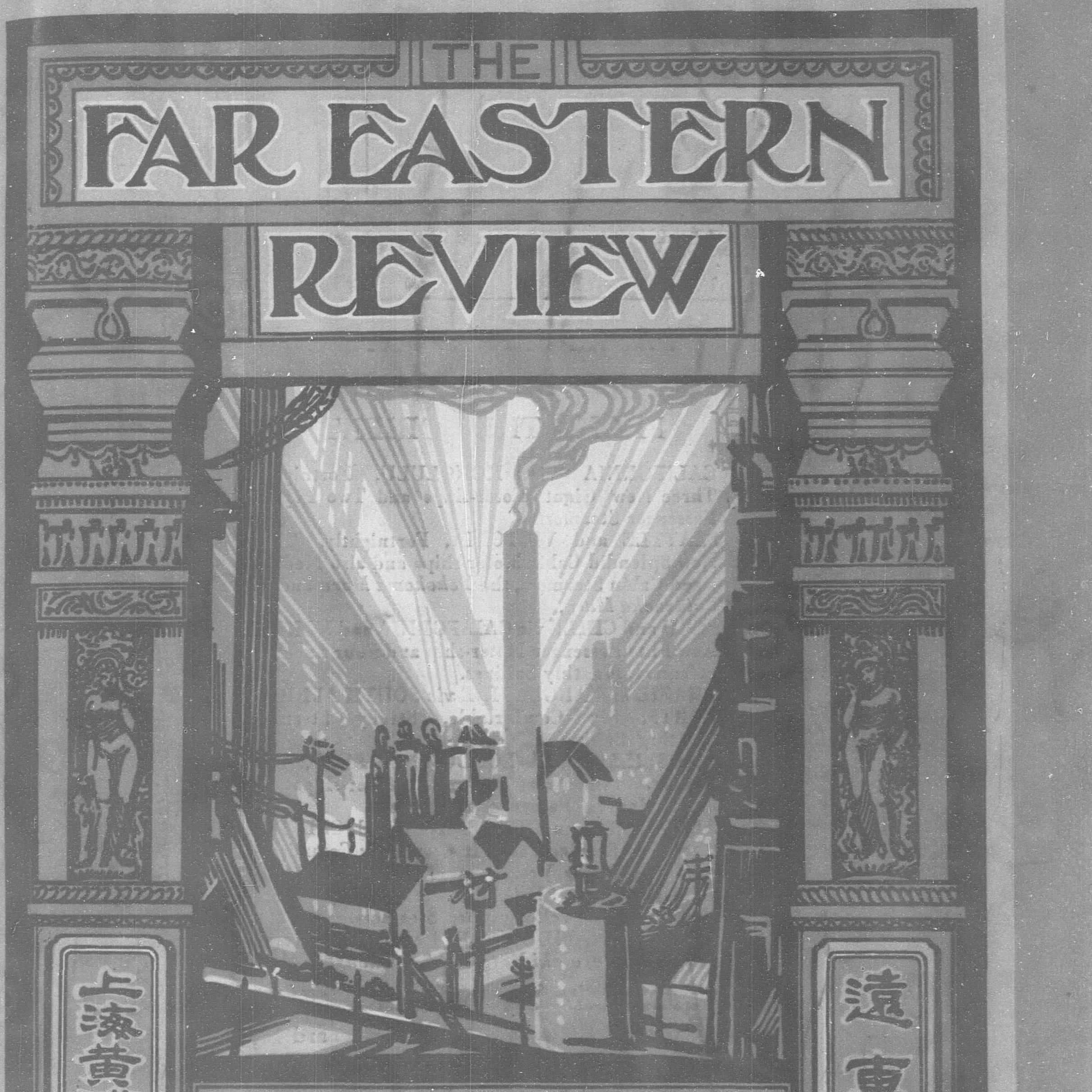

THE MENACE IN MANCHURIA

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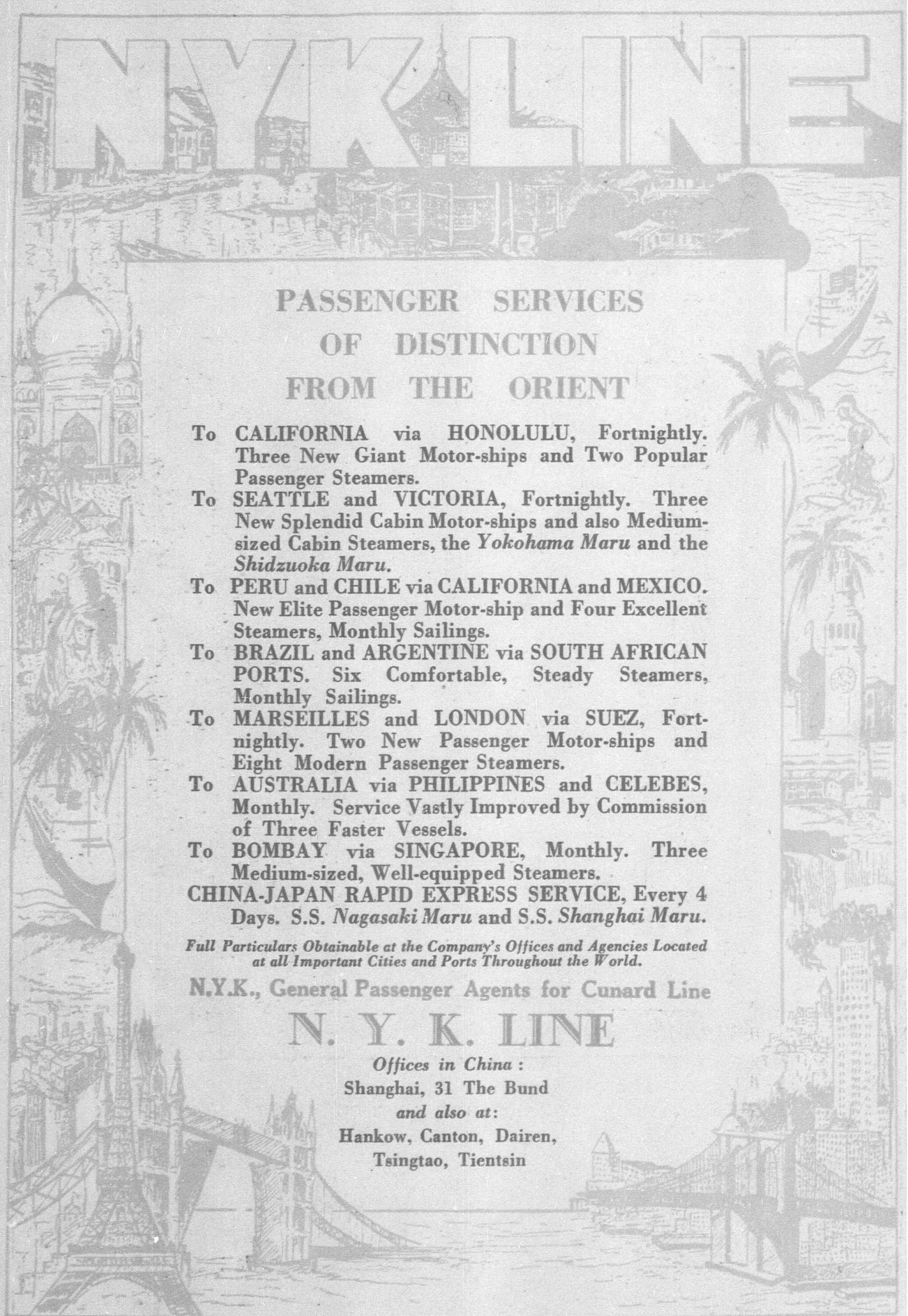

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The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXVII SHANGHAI, AUGUST, 1931 No. 8

The Communist Menace in Manchuria

By GEO. BRONSON REA

IN Soviet Russia the masses toil for the State. The government is the sole employer of labor. It fixes wages and pays the workers with a meal ticket or requisition order on the government monopoly stores for their household supplies. Trade unionists and party members are paid in unsecured paper notes but as these have no value outside the country and must be exchanged for commodities sold by the official trusts, the result is the same. They labor for the State. The people of Russia have the satisfaction of knowing that the profits from their toil are being expended for the betterment of their living and working conditions and for national defense. The billions that roll into the state treasury from official enterprises and co-operative farms are used to purchase all manner of railway, textile, electrical, mining and other industrial machinery ; to erect houses, lay out new cities ; to build roads, waterworks, sewers, public utilities, schools, social and amusement centers, and other betterments designed for public welfare. The workers of Russia are slaving for an ideal ; they are a people with hope. Bad as their present lot is, it is infinitely better, brighter and more full of promise than it was under the despotism of the Czars.

If the Five Year Plan is carried out—even in ten years—its success will bring about a revolution in world economy. If they can do things better in Soviet Russia than in the so-called capitalistic states, our industrial system must be modified to meet the competition. For the moment, the people of Russia may be slaves, insufficiently nourished, poorly clothed, inadequately housed and denied the luxuries and even the comforts of life, but if their hardships lead them to their ultimate goal, a new and brighter outlook will be created for the other workers of the world. A great humanitarian principle underlies the economic experiment taking place in Russia and if successful, even in part, it will exert a stupendous influence on the future of the human race. It's success may bring disaster to other industrial nations and overturn the existing social order, but the people of Russia are entitled to work out their theories and problems in their own way without outside interference. Their bondage is of their own seeking.

Under the old régime, the peasants of Russia were slaves of the landowners, toiling from cradle to the grave to maintain in idleness and luxury a ruling caste that opposed any and every program for reform. When the opportunity came, the serfs rose against their oppressors and re-enacted the tragedy of the French Revolution. The old system has disappeared. Private property is abolished. The land is parcelled out in co-operative farms held in common for the common good. The Soviet philosophy has permeated all of Central Asia. Mongolia is now part of the Soviet system. Chinese Turkestan is wholly dependent upon the Soviet for its economic existence. Communist propaganda is undermining the allegiance of the people to their Chinese overlords, and with the strengthening of Soviet trade ties, this region with its immense mineral and oil deposits, will slip automatically into the Soviet system.

China's inability to assert her authority over these distant border provinces, coupled with the graft, corruption, ineptitude and tyranny of the Chinese officials, is paving the way for the triumph of Communism. Mongolia, Sinkiang, the Barga Region, a large part of Tibet and a slice out of Kirin in the Ussuri district are practically lost to China. No treaty of peace and commerce ; no understanding between Moscow and Mukden can check the relentless march of the Soviet in these regions.

We have seen how the germs of communism have taken root in the Yangtsze Valley how in desperation the patient, downtrodden people have espoused a cause that holds out some promise of escape from their enforced enslavement ; we have witnessed this movement grow to such proportions that it now menaces the very existence of the nation. We call it " communism " in order to rally world opinion to the support of the National Government in its desperate struggle to preserve the fiction of its power and carry out its international obligations. But we have the testimony of Generalissimo Chiang Kai-shek that the upheaval in Central China is merely the anarchy of despair ; the revolt of oppressed humanity against the hordes of political spoilsmen let loose upon the country by the new Kuomintang dispensation. Chinese officialdom may delude themselves and the world into believing that Moscow is responsible for the present tragedy in the Yangtsze Valley, but those who have an intimate knowledge of China's internal affairs know this to be false. The truth about conditions in China is eloquently revealed in Chiang Kai-shek's wrathful and denunicatory arraignment of the system he himself is responsible for fastening upon the people by force of arms. The lesson of Central China is before us. It carries its moral to the other feudal tyrants who rule the country.

What is China doing to combat the influence of communism in her border provinces? Let us step across the boundary of Asiatic Russia into Manchuria and study the system imposed upon the people by the Northern military satraps. Here we find a vast territory that thirty years ago was a bandit-infested wilderness (the ancestral homeland of the Manchu bannermen who conquered China, ruled over by a Tartar general and closed to Chinese penetration and colonization. In order to be revenged upon Japan for his defeat in 1895, Li Hung-chang entered into a secret treaty of alliance with Russia, which handed over Manchuria to the domination of the Czar. The Russian armies marched into the new land of promise, built strategic railways, founded cities and created ports, pouring a vast amount of wealth into the pockets of the poverty stricken Manchurian peasantry and their extortionate rulers. The Russians created no wealth. They opened no mines. They established no industries. The flood of Russian gold was expended for purely military and strategic purposes. Attracted by this influx of foreign money, Chinese from the south began to filtrate through the immigration barriers at the Great Wall.

The Russo-Japanese war distributed another avalanche of foreign gold to the people of Manchuria. The war was followed by an era of unprecedented prosperity. Railways were built, modern industries established, mines opened, cities planned and public works initiated. All obstacles to the entrance of immigrants from other parts of China were swept away in the rush to find employment. The Homeland of the Manchus became an economic colony of their empire and when the Revolution in 1911 swept them into the discard, their birthright was ruthlessly annexed and incorporated into the Chinese Republic. Manchuria was overrun, occupied and settled by the needy sons of Han and

proclaimed an integral part of their own country. Then came the crowning event that established the prosperity of Manchuria on a firm basis.

In 1908, the great Japanese firm of Mitsui dispatched a trial cargo of soya beans to Liverpool and created a new market for the staple crop of the territory. From that date commences the rise of Manchuria. Foreign firms opened branch offices in the territory to participate in the profits from exporting the bean crop and in this competition the Manchurian farmers enjoyed a free market and the highest prices. It is not necessary in this article to trace the phenomenal development of the soya bean industry. Sufficient to state that the crop increased from 34,429,000 bushels in 1915 to 221,824,549 bushels (5,351,130 tons) in 1929, representing 63 per cent of the total world production. Of this amount, about 2,000,000 tons are consumed locally, leaving 3,000,000 tons for export to the oil mills of Europe. The Manchurian soya bean has revolutionized the stock breeding and dairy industries of Denmark and Holland, enabling these small agricultural states to develop an enormous trade in animal products, butter, cheese, bacon, ham, eggs and also live stock, which in the case of Denmark makes up over 70 per cent of its total exports. Holland is in a similar position.

The average price of the beans laid down in Europe over a period of years has been Y.100 per ton. Of this, forty per cent represents transportation charges; Yen. 14 per ton ocean freight from Vladivostok or Dairen to Europe and Y.26 railway freight from Harbin or Anda to either shipping port, or Y.60 net a ton at Harbin. After deducting for cartage, bagging and other charges, the farmers who work their lands on a fifty-fifty basis with the landowners receive about Y.55 a ton. At these top prices, the 3,000,000 tons of export beans brought about Y.180,000,000 a year in real money into Manchuria. Most of the railway freight charges, or another Y.78,000,000, also remained in the country. Money was easy. Industry prospered. Japanese capital to the amount of nearly Y.1,500,000,000 flowed into the provinces and created new sources of wealth. Under the protection of the Japanese, a new era was ushered in. The Chinese overlords were presented with sources of revenues that more than met their most extravagant demands.

Manchuria was like the goose in the fairy story. It belonged to a fee, faw fie, fum, Red Beard Giant, who lived in the Dragon Castle in the Manchu Heaven at Fengtien, guarded by ferocious fire-eaters and dare-to-die's selected from the most valiant of the dreaded Hunghutze bandits. When Chang, the Manchu Goliath finished his daily recreation of counting his soldiers and inspecting their arms, he called for his pipe, his bowl, his fiddlers three, gathered around him the beauties of his harem and gave himself up to oriental pleasures and dreams of greatness. His favorite evening indoor sport culminated in bringing out the goose and commanding it to lay. The goose did its stuff with clocklike regularity. If at times it lagged, grew weary of the strain and let out a protesting squawk, a gentle squeeze was sufficient to remind it of its duty. The golden eggs rolled into the Giant's strong box in a steady stream. There was always more where they came from. Chang grew ambitious for more power and reached out for new lands to conquer. He raised and equipped the most formidable armies in Asia, erected the largest arsenal in the world, and set out to impose his rule over the rest of the Celestial countries. His conquering hosts overran the provinces of China and he finally transferred his court to the city of Kublai Khan and settled down on the Dragon Throne with the intention of founding a new dynasty. But China, alas, was an impoverished country. It had been sucked dry. So the good, old, bean-fed Manchurian goose was brought to Peking and worked overtime. It was squeezed and beaten until it quacked in agony and gave up the ghost. Chang and his intimates took the goose apart to see how it worked and discovered that the gold was after all only transmuted soya beans. So they gaily plucked, drew, fricassed and ate the bird and invented a new machine to convert the beans into the precious metal without all the complicated machinery that cluttered up the inside of the goose.

In other words, there was a limit to taxation. The farmers grumbled at their constantly increasing burdens and a revolt seemed imminent. Nevertheless, the farmers continued to prosper. They still received real money in exchange for their three million tons of export beans, salting their savings away in the native banks which loaned the funds out at usurious rates of interest to Marshal Chang to pay his armies with. At sixty yen net per ton, there was something like one hundred and eighty million gold yen distributed to the farmers, who after paying their heavy taxes, still had a lot of hard cash that was sorely needed for the armies. Only by diverting all this money into the coffers of Chang could he continue his wars of conquest. So the Manchurian war-lord issued an edict prohibiting any further sales of beans direct from the farmer to the middlemen or exporting firms. The whole crop must be sold to an official purchasing organization created by Marshal Chang and his associates. In the meantime, the three Manchurian rulers ordered some new printing presses from abroad, loaded up with a big stock of fairly strong paper and started to print an entirely new issue of beautiful crisp paper notes in various denominations to be used as currency for paying the stupid farmers for their bean crop. Was there a gold or silver reserve behind these notes? Was there even a supply of copper behind the billions of copper *tiao* notes? Perish the thought. What is the use of being an autocrat with a printing press and an unlimited stock of good white paper, if an accounting must be made to the people for every note struck off. No; there was no reserve, no security, that is, none that could be discovered by the most expert foreign investigators. The real security behind these issues was the grain crop that belonged to the peasant. As long as the demand from abroad held firm at top prices, and the money was all paid into the Government, or its issuing banks, the paper notes enjoyed a certain value. Perhaps the first few issues were more or less secured by the silver reserves in the official banks of the three provinces (Fengtien, Kirin and Heilungkiang) and were accepted at or about par. Now, when the organization was completed, the new gold transmuting machine began to function. It was so simple that it is a wonder it was not thought of before. The farmer, under compulsion of course, merely delivered his bean crop to the nearest district purchasing and collecting depôt, handing it over to the government supervisor—or whatever he is called—and received in payment a wad of nice new dollar or *tiao* notes fresh from the provincial printing press. In some districts, I am told that these notes were even fresher. It is alleged that in Heilungkiang, the official purchasers travel around from village to village with a portable printing press and a supply of paper and printing ink. After making a rough estimate of the yield in the district, they turn out the required number of *tiao* notes to pay the farmers for their beans, take delivery and proceed to the next transmuting station. This is perhaps an exaggeration. The essential fact is that the crop is gradually collected and transported to various shipping centers where it is sold by the official combine to the exporting firms who pay in good hard cash, and *gold* at that. Although the legal currency in Manchuria is based nominally on silver or copper, all important business is transacted in Japanese Gold Yen. Try and pay a bill in Harbin with a Tiao Note. They don't even know what one looks like. Marshal Chang killed the goose but the new process of transmuting beans into pure gold was much more satisfactory and efficient. There was no waste. The Government got all the beans in exchange for incontrovertible paper and exchanged the beans for gold. The new invention worked beautifully. For several years the proceeds from the toil and product of the farmers went to swell the hoards of gold in possession of Chang and his captains. But a turn had to come. The value of the notes gradually declined. Exchange brokers began to manipulate the market. When their operations became too bold Marshal Chang simply had a few of the most important speculators arrested, stood up against a stone wall and summarily shot. This drastic method of fixing the exchange worked just as efficiently as the transmuting machine. New note issues were accepted at their face value without a murmur.

Nobody knows the exact or approximately exact amount of these unsecured notes circulating in Manchuria. There are all kinds of official, semi-official and purely private lists giving the amount of paper currency issued by the provincial banks. It would serve no useful purpose to scrutinize and analyze these various lists in order to arrive at an intelligent estimate of the total issue. It is generally admitted that the total is somewhere between six and seven billion dollars. For the sake of convenience we take the following table of the varied currency circulating in Manchuria at the end of December 1929 from the "Second Report on Progress in Manchuria to 1930" issued by the South Manchuria Railway Company.

Name of Currency	*Estimated amount in circulation*	*Exchange rate against 100 Silver Dolars*	*Value in Silver Dollars*	*Circulation Area*
Mukden Notes	3,000,000,000 Yuan (Mukden Dollar)	6,000 Yuan	50,000,000	Mukden Prov.
Silver Dollar Notes	45,000,000 Yuan	100 Yuan	45,000,000	,,
Harbin Tayan Notes	37,300,000 Yuan	140 Yuan	28,071,000	Harbin and C.E.R. Zone
Govt. Notes of Kirin Prov.	10,000,000,000 Tiao	20,000 Tiao	50,000,000	Kirin Province
Kirin Yunghen Tayan Notes	10,000,000 Yuan	145 Yuan	6,897,000	,,
Govt. Notes of Amur Prov.	12,000,000,000 Tiao	40,000 Tiao	30,000,000	Amur Province
Amur Kuanghsin Tayan Notes	10,000,000 Yuan	140 Yuan	7,143,000	,,
Sycee kept in Antung	2,000,000 Taels	82 Taels	2,488,000	Antung
Transfer Account in Newchwang	15,000,000 Taels	210 Taels	7,134,000	Newchwang
Silver Dollar	1,000,000 Yuan	100 Yuan	1,000,000	Manchuria and Inner Mongolia
Small Silver Coin	5,000,000 Yuan	114 Yuan	4,386,000	Manchuria
Total			232,128,000	

We do not vouch for the accuracy of the above table but it is near enough to the truth to enable the reader to understand what has been taking place in Manchuria. These figures are eloquent of how efficiently the new transmuting process operated. They give some idea of what militarism is doing to China. They reveal at a glance the reason for a nation's impoverishment, the degradation and enslaving of a patient, unlettered people that has no parallel in modern history, not even in Soviet Russia. Look at the astronomical figures in the table. Eliminate all other figures and concentrate on the Mukden dollar and the Kirin and Heilungkiang *tiao* issues. The story of Manchuria lies in these three items. The Mukden dollar notes (called in the vernacular *Fengpiao*) in circulation, are estimated at three billion, worth in December 1929, $50,000,000 silver, or sixty Fengpiao to the silver dollar. By the end of December 1930, these notes depreciated to 118 Fengpiao to the silver dollar. These dollar notes are nominally based on silver and with this depreciation in their value we can understand better what happened to the Kirin and Heilungkiang *tiao* based on copper.

Originally, the *tiao* represented fifty copper cash with about eight *tiao* to the silver dollar. The closing down of the mints in China proper and Manchuria, the exportation of cash and copper coins during the war and the subsequent rise in the price of the metal caused this currency to practically disappear. There are no more copper coins in Manchuria. When it was no longer profitable to purchase and mint copper, the authorities met the demand for small currency by issuing *tiao* notes, nominally based on the copper coins—only there is no copper. These billions are simply paper.

I interviewed several currency experts in Manchuria in an endeavor to ascertain the nominal value of the *tiao* in order to convert the astronomical figures into dollars. They all disagreed. Some had never even seen a *tiao*. With twenty odd billion *tiao* notes circulating in the two provinces, few foreigners in Harbin knew their value or even what they looked like.

A Japanese bank manager, expert in Manchurian currencies, explained that 480 cash equalled one *tiao*; ten cash equalled one copper; there are 360 coppers to the dollar, therefore a dollar of 3,600 cash is equivalent to about eight *tiao*. The ten billion note issue of Kirin at this normal exchange is $1,250,000,000; the twelve billion Heilungkiang issue about $1,500,000,000, or a total of $5,750,000,000 silver for the three provincial issues. When all other official and private issues are included, it is safe to estimate the total at over six billions.

In order to chase down the elusive *tiao*, I took an interpreter and started out to visit the exchange shops. The first five shops in the main business street of Harbin had no *tiao*. Finally, in one of the big shops near the market, we had luck. Plenty of *tiao*. How many thousand did I require? I negotiated for the purchase of a new 100 Heilungkiang *tiao* note and paid for it just ten cents Harbin money, which is considerably less than its Shanghai equivalent. Assuming a value on a parity with other silver, the twelve billion Heilungkiang issue is worth to-day $12,000,000 silver. I then bought a 100 Kirin *tiao* note but had to pay thirty-five cents Harbin money for it, which gives to the note issue of that province a value of say $35,000,000 silver. These two provincial issues nominally valued at $2,750,000,000 are therefore worth to-day about $50,000,000, an exchange of 55 to one. As the three billion Fengpiao were worth on the first of the year about $30,000,000 silver, the total value of the three provincial note issues is approximately $77,000,000 silver or an exchange rate of 75 to one.

Obviously, this is a very rough calculation subject to considerable modification in actual exchange transactions in large amounts. But it is sufficient to paint the background of the picture and expose the working of the machine which transmutes the soya beans into gold. As long as the price of beans was maintained at its former high level the value of the *tiao* was more or less stabilized by the value of the crop and the stocks held by the official purchasing organization. It is only when the bottom drops out of the market that the value of the bean reserve disappears. This last year, owing to the depression in Europe the demand has fallen off, the price delivered in London declining to Y.62 per ton. The ocean and railway freight charges remain the same (Y.40) which leaves Y.20 net at Harbin or other interior shipping points. After deducting cartage, sacking, handling and other incidental charges, the farmer receives about Y.16, a ton, half of which he shares with the landowner. An acre of land yields about 22 bushels of beans equivalent to .53 ton. So the farmer, if he is lucky, may receive as much as Y.4 from an acre of land, or say $10 silver. His income therefore depends upon the extent of his holdings. As the average holding is ten acres his income is about $100 silver a year. This in the Great Land of Opportunity so widely advertised as the solution to China's over-population problem!

The transmuting process has been operating for about six years, five at top prices or Y. 60 at Harbin, and one year where the exports have fallen off to about 2,000,000 tons at Y, 20. This gives us:

3,000,000 tons of export beans at Y.60 × 5	Y.900,000,000
2,000,000 ,, ,, ,, ,, ,, 20	40,000,000
Total	Y.940,000,000

In the last six years therefore, roughly one billion yen in gold has been collected by the official purchasing combine from the sale of the bean crop against which they have issued the equivalent of six billion dollar notes. With this gold income of Y.160,000,000 a year, the overlords of Manchuria have maintained their armies at a strength of nearly 400,000 and prosecuted their wars of conquest south of the Wall. As long as the foreign demand for beans held at three million tons at top prices, the Manchurian authorities were assured of a fixed income in gold that met all their requirements, but with the drop in exports and decline to one-third of the top price, they are now facing disaster.

From this rough picture we can begin to understand why the Manchurian generals, although perfectly willing to accept the nominal rule of Nanking, resolutely refuse to permit the Kuomintang spoilsmen to interfere in the internal affairs of their bailiwick. They have created their own system of taxation, tantamount to confiscation, which operates to perfection and they have no intention of letting any outsider participate in the profits. Manchuria remains an independent autonomous state, with its own currencies and administrative machinery well oiled and working smoothly. As long as the Manchurian militarists confine their attention and activities to their own territory they are assured of sufficient funds, even at bottom prices, to retain their authority and hold over the people. But when their ambitions lure them outside the Wall and they are compelled to maintain a large army of occupation in North and Central China and wage war to hold this territory, bumper grain crops are an essential corollary. If the bottom drops out of the market, as it has done this last year, the efficiency of the transmuting machinery suffers accordingly. At the present moment, the machine is idle, with a Manchurian army occupying Peking and North China. The Manchurian generals are being deprived of their revenues and drained of their reserves to finance the adventure of their young commander at a time when the prospect of replenishing their exchequer is far from bright. Another year of depression with a further falling off in the export demand and decline in prices will bring ruin to Manchuria. Thinking Chinese see it coming are loud in their criticism of a policy that is draining away the gold from Manchuria in

unprofitable campaigns and political adventures for the unification of the country under a régime they will never permit to function north of the Great Wall.

This, however, is merely a side issue. The real danger lurking in the background is the condition and mental attitude of the Manchurian farmers who have absorbed the six billions of incontrovertible dollar and *tiao* notes. How long will they remain passive under a confiscatory system that takes the product of their toil and gives them in exchange a slip of paper? What is the difference between the Soviet system of enforced labor for the benefit of the State and the taxation system of the Manchurian militarists? For all practical purposes the two systems are identical; the laborer in both countries being paid in paper, whether it takes the form of paper roubles, a meal ticket or requisition order in Russia or the *tiao* note in Manchuria. They are both slaves, with the distinction that whereas the Russian is voluntarily slaving for the attainment of an ideal and sees the profits from his labors expended for his welfare, the Chinese farmer has no outlook, no hope of bettering his condition. The product of his toil goes to defray the cost of maintaining the machine that perpetuates his bondage. Again, with this rough picture before us, we can understand better the attitude of the Manchurian authorities toward communist propaganda in the north; why they raided the Soviet consulate in 1929, to justify which they published the alleged documents seized at that time. There is an ever present fear that the "stupid people" will discover how they have been enslaved to the military system. So far, however, a relative prosperity has been enjoyed by the Manchurian farmer. But these conditions are rapidly changing. Another year of depression, of low prices and a slump in exports will bring the wolf of hunger to the doors of millions who have crowded into the Land of Promise only to become serfs of the official landowning class.

There was a time years ago when immigrants from south of the Wall could find free land in Manchuria to settle on, but that day is long past. All available cultivable land has been parcelled out into big grants amongst the higher Chinese officials and the new-comer who now seeks his fortune in Manchuria must become a tenant farmer, working his lands on shares with the big landowner who resides in the comparatively safe precincts of the provincial capitals or large cities. For all practical purposes, the immigrant becomes a peon, a serf, held in bondage by the system which keeps him permanently in debt to his overlords. Under this system the later arrivals in Manchuria find themselves in exactly the same economic position as the pre-war Russian farmers, serfs of the ruling classes. They have simply jumped from the frying pan of Shantung into the fire of Heilungkiang and Kirin; from poverty, persecution, hunger and grinding taxation into the shackles of a hopeless slavery.

It is foolish to prophecy what the Chinese will do, as the laws of logic and deduction which hold good in other advanced countries fail to operate with a people steeped in abyssmal ignorance, superstition and racial traditions. The Manchurian farmers may remain contented with their lot, but the stage is set for trouble.

A prolongation of the present depression with its attendant hunger, cold and privation may drive these people to desperation; to the point where, like their fellow countrymen in the Yangtsze Valley, they also will take to the field in arms against their oppressors. The nucleus of communist armies are everywhere in evidence throughout Manchuria. The bandits are still operating on as large a scale as in the past. Nearly every Manchurian farmer owns a rifle or shot-gun for the defense of his home. The majority of these farmhouses are in reality walled forts. Many of the farmers are bandits and when the *kaoliang* is ripe they like to take a pot shot at a Japanese railway guard just to keep their hand in. The material is all there in Manchuria for a first class upheaval.

If the Soviet should take advantage of the present distress to propagate their ideas, the spread of communism in Manchuria would become a graver menace to the integrity of the nation than the movement in the Yangtsze regions. It is only a step over the almost invisible dividing line between the two systems of government, a step that would definitely swing North Manchuria into the Soviet sphere. It is a real danger, a condition and not a theory that is confronting China in her northeastern provinces.

If Communism succeeds in getting a strong foothold in Kirin and Heilungkiang, another military campaign on a grand scale will be necessary to stamp out the movement. The real fight for the control of Eastern Asia will then start, with the Chinese communist armies led by Soviet generals and munitioned from across the border. The peaceful, plodding, patient Chinese serf driven to despair by the exactions of his overlords, will be mowed down by machine-guns in the name of established law and order.

Militarism will perpetuate its power at all costs. It is a vicious circle that people in other lands fed by propaganda emanating from Peking, Mukden and Nanking fail to realize. The farmer is degraded into slavery in order to maintain his oppressors in power and when in desperation he revolts, he is called a communist, to be hunted down and exterminated like a wild beast, while the rest of the world looks on and applauds.

REALITIES

Recognition is not Intervention

By GEO. BRONSON REA

Two hundred million unemployed: Nearly half the population of China without means of earning a living! This estimate, based on conditions existing in 120 districts, was recently made public by the Ministry of Interior.

Three million people dead from unnatural causes with six millions facing starvation, is the report which comes from Kansu, Kokonor and Ninghsia. Cannabalism is not uncommon in these regions.

Ten million people have fled from the province of Kiangsi, more than 100,000 homes have been destroyed, 180,000 people killed and property to the value of $700,000,000 destroyed in this province. *Generalissimo Chiang reports the communists have been wiped out!*

Five million people were starved to death last year in Shensi and Shansi, the direct result of quartering the armies of Feng Yu-hsiang in these districts. A hundred thousand or more young women were sold to the dive-keepers of other provinces, and taxed as they passed through the likin station.

Now comes the crowning disaster. The Yangtsze River has risen to unprecedented heights, inundating about 50,000 square miles of territory in the provinces of Hupeh, Hunan, Kiangsi, Anhwei and Kiangsu. Over four million homes have been swept away. Thirty million people are homeless; ten million are facing famine; six million acres of farming land are flooded; the Wu Han cities are under water; a total initial damage of $200,000,000 is reported. The real horror is yet to come. Other rivers in China are breaking through the dykes, spreading disaster, hunger and death to further millions of helpless people.

The picture of Manchuria is outlined in another article in this issue of *The Far Eastern Review*. The three most prosperous provinces of China have been systematically looted over a period of years to support the armies which hold the "stupid people" in bondage to their overlords. Over six billion dollars in worthless paper notes have been forced on the farmers in exchange for their export crops. Nearly a billion gold yen has been raised in this manner during the past six years to pay for the armies of the Manchurian military oligarchy. Another year of decline in demand and low prices for the soya bean, will open the way for Soviet domination in North Manchuria. The stage is set there for another calamity.

Half the people in China are without work. Millions are homeless, destitute, starving. The cry of agony, the appeals for succor from the unfortunates fall on deaf ears. The common laws of humanity cannot operate in China. Outside charity cannot be distributed with any guarantee that the funds or supplies will reach the suffering people. The calamity in China comes at a time when the unemployed millions of other countries are standing in the bread lines, living on the charity of their own peoples and governments.

There is no money in China for famine or flood relief. Every dollar that can be squeezed from the people in taxes or through confiscation of property and wealth goes to maintain the vampire armies sucking the last drop of the people's blood. The money that might be employed for the relief of humanity cannot be diverted from the purchase of arms and munitions. The maintenance of law and order, the first duty of organized government is subordinated to the perpetuation of military rule. Over five million armed men are living upon the impoverished people. Three million men are incorporated in the 288 divisions that make up the various provincial armies. Nearly one million comprise the army of Chiang Kai-shek, the backbone of the National Government. The Manchurian armies number at least 500,000; Szechuen has over 300,000; Kwangsi and Kwangtung another 200,000. God alone knows just how many men are carrying a rifle in China. The bandits, communists and independent armies number more than two million. How are they paid? They are not paid. They eat however, and must be clothed, armed and munitioned. The armies are equipped with the most modern death dealing instruments; artillery, machine-guns, aeroplanes, tanks, trucks and automobiles, all purchased from abroad.

We know how the money has been raised to maintain the Manchurian armies, prosecute wars of conquest and build the largest arsenal in the world. In the published budget figures of Minister Soong, we get a glimpse of the sources from which are derived the means to keep Nanking in power. According to the budget of 1930 the National armies cost $245,000,000 with a deficit of $100,000,000 made up by borrowing. This year the deficit will reach nearly $280,000,000. We know how Nanking has been able to raise the funds to pay for its armies and its wars of pacification and unification. Most of it has come from foreign trade; the result of tariff autonomy conceded by the foreign powers in order to assist Nanking to establish its rule. We know that the Szechuen army is maintained largely by the revenues from the opium traffic. The same with the armies of Kwangsi and Yunnan.

The 1931 Nanking budget reveals that military expenses account for 87.5 per cent of the government's total revenues. The new wars that must be waged to compel the Canton group to recognize the dictatorship of Chiang and the further campaigns necessary to establish his rule over other recalcitrant provinces will call for additional sources of revenues to feed the military moloch. *Millions for conquest, but not one cent for relief!* Faced with the catastrophic floods on the Yangtsze, and the urgent need for relief, the treasury of Nanking is empty. To meet this national disaster, Nanking's sole remedy is to float an internal loan of $20,000,000, a mere gesture that cannot hope to cope with the emergency. But the imports of foreign arms and munitions continue. Nanking is continually purchasing new equipment. The "independent" provinces find no difficulty in having all their arms requirements supplied from abroad. Arms, arms and more arms! Artillery, machine-guns, automatics, rifles, aeroplanes and all the paraphernalia for modern civilized slaughter are pouring into China. These must be paid for. Money, money; loans, loans and more loans; taxes and more taxes are needed to meet the bills.

No nation, no matter how strong or prosperous can stand the exactions of such a system. The hungry people, driven to desperation swell the ranks of the roving bandits and communist organization; then they must be killed off in order that government by the bayonet may endure. The people of China have no vote, no voice in the conduct of their own affairs. They have become the abject slaves of their military taskmasters and when in despair, they revolt against their enforced bondage, the military machine is set in motion to exterminate them.

The people of China through their glib-tongued self-appointed foreign educated spokesmen, have demanded from the rest of the world the right to solve their problems in their own way without outside interference. That right has been conceded. The result is before us. In the face of the appalling conditions throughout the country, Humanity at large has the right to demand by what authority these champions speak in the name of the inarticulate millions whose rights as human beings are being sacrificed to a mistaken pride of race and a stubborn refusal on the part of their more vocal political leaders to admit their inability to establish a government capable of discharging its most rudimentary obligation. Under the slogan of unification, which in Chinese means the right of one overlord or faction to impose its will upon the rest of the country, millions upon millions of human beings have been done to death, and the country is further off from unification than ever.

For, let us make no mistake about the aims and aspirations of the several factions now ruling the country. The ambition of every warlord, every political henchman and their hangers-on is to conquer and rule the rest of the ethnological group, called for the want of a better name, the Chinese nation. There is no Chinese nation. There is a Mongolian race to which the various peoples and clans that inhabit what is known as China, belong. There is as much difference between the Manchurian and the Cantonese, in language, customs, manner of thought and living as there is between the Norwegian and the Greek. China is a continent inhabited by a race split into as many diverse nationalities as Europe. The only bond is one of race, the same bond that unites the people of Europe into one common division of mankind. Until the Chinese themselves recognize this basic truth and are willing to settle their differences by a mutual recognition of each others independence there can be no permanent peace in Cathay. The picture of China is the reflection of medieval Europe. As at various periods in history one European nation has attempted to subjugate all the others, so in China each province has at some time or other set out to conquer the others and impose its rule. No province of China will ever relinquish its claims to rule over an undivided country and in the process of establishing its authority by force of arms, no more consideration is given to the rights of the people than Alexander, Caesar or Napoleon extended to the vanquished states of Europe.

It is conceivable that with the recognition and support of the foreign powers, some dictator may ultimately unify China under one government, but in the last analysis it can be achieved only by conquest and after a series of devastating wars eclipsing in horror all other wars in the history of the world. A government or empire created by force must be maintained by force. Another decade of civil warfare in China will convert the Chinese into a warlike nation, with an army thirsty for more lands to conquer. This is what unification by the sword means to China; the continued degradation and enforced enslavement of a quarter of the human race to pay for the upkeep of the system which maintains them in bondage. Not until the rulers of China hold their office by the consent of the governed can the power of the militarist be broken.

Canton has broken away from Nanking and is preparing for another war to overthrow the dictatorship of the Chekiang oligarchy. Canton announces that it proposes to put an end to military rule in China, and establish a government of the people by the people and for the people. An excellent slogan with which to fool the masses and the outside world. It will be another century at least before the people of China can be educated in the rudiments of self government. With all available revenues being used to maintain the armies which keep the stupid people in subjection, there is little hope that any considerable sums will be available for any purpose that will tend to weaken the military system. With 96 per cent of illiteracy, it is hopeless to expect that the peoples of China, can manage their own affairs. They will remain slaves of the system that their ignorance, poverty and weakness has fastened upon them; a system that has no more regard for their welfare than a ravenous tiger has for its prey.

Is there a remedy? Is there any way to liberate the people of China from their present bondage? How far is the outside world responsible for the present military system? Are we justified in recognizing that the Chinese people constitute one nation whose territorial integrity is sacrosanct? Must we perpetuate the diplomatic absurdity that a country as large as a continent must be united under one government no matter what the cost to humanity? In pursuit of this mistaken policy evolved in the brain of an American statesman ignorant of the real facts, the preservation of China's territorial integrity and her undiminished sovereignty over these regions has become a cardinal principle in Far Eastern diplomacy. Yet at the very time, the principle was

announced, China had secretly handed over Manchuria to Russia under the terms of a military alliance designed to crush and humiliate Japan. Japan was bound hand and foot to respect the integrity of China, while China and Russia were secretly preparing to crush out her existence.

Japan is once more facing a similar menace to her security. Mongolia has been painlessly amputated from the main body of China and annexed to Soviet Russia. Sinkiang is going the same way. The Barga region is slipping. The pressure of the Slav is slowly converting the outlying provinces of China into Soviet republics. The Mongols have asserted their right to self determination and the rest of the world has recognized the accomplished fact. When Sinkiang declares its independence, Moscow will recognize the new state and again the outside world will accept the inevitable. Moscow does not recognize the principle of China's territorial integrity. Slowly, but surely the Communists are tearing China apart, while the other Powers adhere religiously to a worn out doctrine that no statesman has the courage to puncture.

In pursuit of the antiquated Hay Doctrine, obligations have been loaded on the people of China until now they constitute an almost unsurmountable barrier to any solution of China's problem by the creation of three or more independent states. The foreign debt of China secured mainly on the Customs, is the sole cement which now binds the Powers together for the enforcement of a principle that to date has brought more misery, death and destruction to Asia than the Great War to Europe. And the end is not yet.

Loans, loans and more loans to the grand total of £150,000,000 have been made to the various so-called governments of China in an endeavor to strengthen the central authority and give effect to a kindergarten doctrine, that the Chinese themselves ridicule and decline to accept. Russia alone understands the Chinese mentality and lack of national consciousness and in lopping off the outlying provinces and spreading her doctrines in other regions, she will ultimately succeed in her program of splitting the Mongolian race into its component parts, recognizing each as a distinct nationality and incorporating their territory into the system of Soviet republics. The other foreign Powers, adhering to the diplomacy of John Hay must either recognize this trend in the affairs of China and shape their policies in harmony with realities, or they must give effect to the doctrine of China's integrity by supporting materially and morally some one faction that can unify the country by the sword and so preserve the principle laid down in 1898. It is hardly probable at this late date that the Powers could be induced to co-operate along such lines. It has been tried time and again and has failed. If international financial support to the present recognized government is impractical, then we must face the other alternative and beat Moscow at its own game.

In 1924, Marshal Chang Tso-lin declared the independence of Manchuria. He refused to recognize the authority of Peking and in October of that year concluded an agreement with the Soviet Government, concerning the status of the Chinese Eastern Railway, which holds good to this day. Manchuria is still an independent state, linked to Nanking under the terms of an agreement that recognizes its rule over all of North China. Marshal Chang Hsueh-liang is not a vanquished war-lord. He is the co-ruler of National China, equal in rank and prerogatives to his military partner in Nanking. The rule of Nanking does not extend to Manchuria. They will not permit the Kuomintang officials to meddle in their affairs. The Northern Chinese look upon the Cantonese as worse "foreign devils" than the blue eyed barbarians from over the sea. Manchuria is independent, peopled by a race which has nothing in common with the peoples of Central or North China.

Whether the rest of the world likes it or not, the segregation of Manchuria into a distinct territorial division will sooner or later have to be recognized. This is the real issue between China and Japan at the present moment. No new treaty of peace or commerce can be negotiated between China and Japan without China's full recognition of Japan's legal rights in Manchuria. Japan is apparently willing to surrender all her special rights in China Proper in return for the reciprocal right to reside in the interior, the right to own and lease property and engage in business, industry and agriculture. These privileges China refuses to concede until such time as Japan surrenders the lease to Liaotung and withdraws her troops from Manchuria. China stands firmly on her declared policy not to recognize the validity of the 1915 Treaty, while Japan just as firmly adheres to her acquired rights under that treaty. No statesman in Japan will discuss the subject. The nation would rise as one man and go to war with the whole world before it surrenders the picayune fruits of its two previous sacrifices. To ask Japan to get out of Manchuria is to ask her to commit suicide. Japan will never recede from her position, so if the aspirations of National China are to be realized, she must be prepared to fight. *The shadow of this conflict is upon us.* Unless China recognizes Japan's acquired rights in Manchuria, any incident may precipitate the crisis. Japan's patience is almost exhausted. A few more Wanpaoshan incidents, a few more murders of Japanese officials, a few more open violations of treaties and agreements, may compel her to act. The situation is ominous, similar in every respect to the lull which preceded the Russo-Japanese conflict. Slowly, but surely Japan is building up her case. The Kellogg Peace Pact, the League of Nations or any other instrument for the abolition of war, will carry no weight when Japan decides that her national existence is at stake. No other nation will interfere in a dispute that will never be submitted to arbitration. The Manchuria problem will be settled on the field of battle. Unless we admit that China is in a position to vanquish Japan, is it worth while to carry the dispute to the stage where war is the only solution? Such a war can have only one ending and in the treaty of peace, Japan will collect the indemnity she was buncoed out of at Portsmouth. China will lose Manchuria.

One way to avert such a war, is for the Powers to acknowledge the realities of the situation and recognize Manchuria as an independent state. Under new treaty relations with Japan and the other Powers, Manchuria will be saved from the Soviet, opened up to foreign capital and development and created into a strong buffer state between Japan and the Soviet or between the Soviet and North China. This is the only alternative to its ultimate incorporation into the Japanese Empire.

Canton has declared its independence, but insists upon its right to re-conquer the rest of China and oust the Chekiang clique that stole the fruits of its former victory. That is the root of the trouble between Canton and Nanking. The Cantonese fomented a revolution; their armies subjugated the rest of China, but their Chekiang military leader, true to Chinese traditions and the call of the clan handed over the big jobs to his fellow provincials and family connections. The nimble-witted Cantonese were defrauded of the spoils of victory by the despised delta-folk of Chekiang. So they must fight the war "to establish a government of, by and for the people of China" all over again. God knows what it will cost the people of China to establish this glorious principle of democracy. Would it not be better for humanity if Canton's independence was recognized by the foreign powers, on the condition that the new state agrees to assume its share of the foreign debt, join the League of Nations, sign the Kellogg Peace Pact and concentrate its energies on improving the welfare of its people? If we admit the right of the Mongols and Central Asian tribes in Sinkiang to apply the principle of self determination; if the successors of Chang Tso-lin can defy the power of the Central Government and preserve an autonomous existence, why should Canton be denied the same right? If the recognition of Canton as a sovereign state will be the means of putting a stop, even a temporary one, to these insensate internecine wars, humanity, common-sense and practical politics demands action along these lines.

An independent Canton, including Kwangsi, Yunnan and Kweichow, will provide the restless and progressive Cantonese the opportunity to show the world and the rest of China what can be done under a government of, by and for the people. Give Canton a chance to work out a solution to this problem as a lesson to the more backward states of China. Under new treaties and guarantees, and a consolidation of its share of the foreign debt, there should be no reason why foreign capital should not flow into the South China Republic, develop its resources and open up a new era of prosperity to the tax-burdened peoples. Intervention, by recognition of the realities may be the only way left open to save China from splitting up into a congery of small Soviet republics tied to Moscow's leading strings. The battle ground of communism for the control of Asia and the world is definitely fixed in China. Communism must be fought with its own weapons. If the Powers insist upon adhering to the outworn doctrine of John Hay, the Soviet will triumph. The country is too vast, the inter-provincial jealousies and prejudices too bitter, to assure unity under one government. Only by the creation of at least four or five distinct compact states can the danger be now averted. *Recognition of the realities is not intervention!*

The Acid Test

By Their Acts—They Will Be Judged!

THIRTY million people are facing starvation and death as a result of the Yangtsze River floods. The National Government of China through the Department of State has opened negotiations with the Federal Farm Aid Board for the purchase of 15,000,000 bushels of American wheat to be paid for in ten to twelve years. While the dickering over prices and credits goes on, typhoid, malaria, dysentery and other diseases are taking their toll of helpless humanity. At the best, it will be two months before the first shipments of American wheat can be delivered on the scene of suffering.

Near at hand, right in China, there are over 800,000 tons or more than 32,000,000 bushels of soya beans left over from the 1930 crop, stored at the central shipping points in Northern Manchuria.

The new crop of 5,000,000 tons or more, will be fully harvested by the first of October and unless the export purchases return to normal, there will be another million tons of soya beans in excess of the demand. By the first of October, or a month before shipments of American wheat can reach Hankow, there will be over two million tons or 88,000,000 bushels of soya beans in Manchuria in excess of the demand.

The 800,000 tons of beans on hand have been delivered to the official purchasing combine by the farmers, who have received in payment worthless issues of *Tiao* or dollar notes and are being held by these predatory organizations for a rise in the market price. These 800,000 tons of food stuff belong to the National Government of China. That is, they are owned by the official group of banks, transport companies and other organizations controlled by Marshal Chang Hsueh-liang, his uncle and the other high Manchurian officials who hold the Three Eastern Provinces as their private preserve. Manchuria is an integral part of China, professing allegiance to the National Government at Nanking. Its young autocrat proclaims himself the Co-Ruler of China, which means he is equally responsible for the welfare and happiness of its people. The Young Marshal and his colleagues in Kirin and Heilungkiang are practical owners of the 800,000 tons of beans now stored at the railway shipping points. They operate a system of Chinese railways that can transport the beans without charge to Peking, where the relief trains can be shunted over to the Peking-Hankow line. Within five days sufficient food can be rushed from Manchuria to Hankow to save the lives of millions of people.

Will the co-rulers of China, who have flimflammed the stupid people of one part of the country out of their crops, be willing to contribute their plunder to save the lives of the unfortunate people of the Yangtsze Valley? The acid test of nationalism and patriotism is confronting the military overlords of China. They have the food, rotting in storage. They have the railroads and means of quick shipment and delivery. The 800,000 tons of soya beans are worth to-day at Harbin say Y.20.00 a ton, or Y.16,000,000. That is, if the stocks can be sold. At present, they are burning last year's beans for fuel, while millions in other parts of China are starving. The usual railway freight charges from Harbin to Vladivostok or Dairen are about Y.26.00 a ton, and say Y.10.00 a ton by steamer to Hankow. As the Chinese have their own system of railways giving through transit from North Manchuria to Hankow, this cost could be saved. All rolling stock is immediately commandeered when the militarists are ready to move their armies. What is necessary for military purposes becomes mandatory for national relief. In plain words, the military rulers of China have it within their power to rush immediate food supplies to the stricken people of the Yangtsze.

Before appealing for help from abroad or negotiating for millions of bushels of American wheat on long term credits, every effort and sacrifice should be made from within to tide over the immediate requirements of the unfortunate people. At the present market price of wheat (about 30 cents a bushel) China will incur another foreign debt of four and a half million gold dollars for the proposed fifteen million bushels. The same quantity of soya beans (340,000 tons at ten dollars gold per ton) would cost $3,400,000 with the avantage of quick delivery. It is true that the beans would have to have the oil extracted before conversion into flour, but the wheat must also be milled. The hundreds of oil mills of Manchuria are idle, but could be started up within 24 hours. If the Manchurian oligarchy must be paid for the goods is it not better to keep the debt within the country rather than incur further foreign obligations? Will Mukden trust Nanking? Will it use the railways of the people for the relief of the people? In the face of this great national calamity, there can be only one answer to these questions.

Negotiations with the American Farm Aid Board may be protracted and the wheat arrive too late to save the lives of starving millions in Hankow. If such should be the case, it is a foregone conclusion that Chinese publicists led doubtless by some renegade or other will attempt to shoulder responsibility upon American imperialists and hard-hearted capitalists for insisting upon reasonable terms and credits at a time when the bread lines of American unemployed constitute a serious menace to our own stability. With several million jobless clamoring for food in the United States, national contributions to foreign famine relief must necessarily be considerably reduced, and where the government is concerned, its charity must be conducted on a business basis.

China has within herself, the goods to relieve her own distress. The outside world is watching and her rulers will be judged by their acts.—G. B. R.

Behind Wanpaoshan

THE truth concerning Wanpaoshan has now been established. It is unnecessary to go over a story whose essentials are merely a duplicate of every other clash between Chinese and foreigners, magnified and distorted out of all semblance to the facts. In our younger days we witnessed the effect of the brazen propaganda that worked upon the feelings of the American people to the point where our government was railroaded into the war with Spain even after the latter had agreed to accept all our demands. Cuban hysteria and a yellow journalism that accepted without hesitation every Cuban lie as gospel truth, changed the map of the world. Up to that time the Cubans took the palm for sheer mendacity, but a few years later handed over their laurels to the "Shanghai Bunder" a generic term which covers all sources of Chinese news.

As the American people were brought to look upon Cuba as a tortured land watered by the blood of martyrs, cold bloodedly butchered by their barbarous Spanish taskmasters, so they were gradually taught to believe that poor old, pacific China was being persecuted by her aggressive and cruel neighbor. The same flood of lies, the same outrageous propaganda tending to instil hatred in the minds of Americans against Japan, nearly succeeded in repeating the error of 1898. War between America and Japan was averted only by a change in the administration at Washington and the determination of a group of cool-headed thinkers to counteract the war propaganda.

The same process of calculated misrepresentation, distortion of facts, calumnies, lies, insults and vicious journalism, is again working to bring about a rupture between China and Japan. There

is no way to counteract this campaign. No appeal to the intelligence or reason of the Chinese people is possible. They do not read and even if they did, no Chinese newspaper would present the Japanese side of the case. Under the new Nationalist educational system, the school children are being taught to look upon Japan as the National enemy. Sooner or later, a crisis will be precipitated and the map of the world again changed as the direct outcome of national antipathies excited by a campaign of lies.

So we come back to Wanpaoshan, in itself a minor incident, but like the straw that broke the camel's back, was more than the Koreans could stand. Wanpaoshan was the culmination of a long series of similar persecutions, of Korean farmers by their Chinese landlords. The situation was very forcibly explained by one of the Korean delegates to the Kyoto Conference, two years ago, in the course of which he said :—

> "The Koreans swarm into Manchuria simply to seek rice.... They have opened vast areas to rice cultivation and in that way have helped the Chinese as well as themselves.... When the Koreans have improved the land, the landlords turn them out."

Needless to say that these continued persecutions or acts of injustice created bad feeling amongst the Koreans, culminating in riots in the south of Korea and in Jinsen in 1927, which were fortunately quickly suppressed by the police. The Wanpaoshan incident was magnified and distorted by the Japanese press and the grapevine telegraph of Asia and inflamed the Koreans to the point of madness. Anybody with a knowledge of what had gone before could see that sooner or later the Koreans would retaliate.

Over a hundred inoffensive Chinese were massacred by the Korean mobs, and in the presentation of the news, the Chinese in turn are being inflamed to retaliate. There is no remedy for this state of affairs. These incidents will continue to create friction and engender hatred as long as the relations between China and Japan remain as they are. The real issue is clearly planted in the negotiations for a new treaty and hinges on the validity of the 1915 treaty. The Chinese will never recognize this treaty and although they are powerless to enforce their viewpoint they have endeavored by every other means to make Japan's position untenable and unprofitable by a slow strangulation of their enterprises in Manchuria.

To China's refusal to recognize the 1915 treaty is traceable nearly all the incidents that create friction in Manchuria. If the terms of that treaty were faithfully lived up to and Japanese subjects could lease land in Manchuria, all these incidents arising from the expulsion of Koreans from the lands they have reclaimed would never have occurred. Viewed from this angle, the total of the claims against the Chinese government would undoubtedly be greater than the amount that Japan is willing to pay as consolation for the massacre of the Chinese by the frenzied mob of Korean killers. One led to the other and the blame must be borne equally by both governments. Japan's reluctance to resort to stronger diplomacy or measures in defense of the rights of her Korean subjects in Manchuria tended to convince the latter that they can hope for no support against these injustices and persecutions of the Chinese and it was only natural that they should take the matter into their own hands. A very good case could be made out that the Chinese massacres in Korea were the direct outcome of Japan's policy of conciliation and peace at any price. Theoretically, the diplomacy of Baron Shidehara is beyond criticism. Patience, forbearance and hope has characterized his policy towards China. Such a broad liberal policy adhered to over a period of years would have convinced any other nation of Japan's disinterested friendship and desire for closer and more harmonious relations. A similar policy won out in regard to the United States. Japan's mistake consists in considering China as a nation, and the Chinese as rational, thinking people.

This desire for amity in relations, and the sentiment of friendly good-will toward China is not merely a considered diplomatic policy ; it is not a measure of expediency ; it is a feeling—in sharp contradistinction to that of the Chinese—that permeates the masses of the Japanese people. The evidence of this is not lacking, for as these lines are written, in the stricken flooded devastation of Hankow many hundreds of destitute starving Chinese have found refuge in the shops and in the homes of the Japanese in the Japanese concession. Foreign refugees arriving in Shanghai from Hankow spoke of this as an outstanding incident of the great cataclysm, and they told how the Japanese, themselves sorely in need, opened their places of abode to the starving Chinese and shared with these fellow-sufferers the meagre stores they possessed.

Nothing that Japan can ever do will convince the Chinese of her good faith and intentions. The Chinese believe that Japan has never surrendered her old ideas of conquest and aggression and knowing that they cannot challenge Japan and defeat her by force of arms, they have set out to ruin her economically, especially in Manchuria. This determination has settled down to a fixed and implacable policy.

The construction of railways in Manchuria designed to impair the value of the South Manchuria Railway, the default on legitimate construction loans ; the construction of Hulutao harbor ; the protests against the Fushun Shale Oil plant ; demands for the retrocession of the Fushun mines ; imposition of exorbitant export duties on Fushun coal ; attempts to kill the Anshan Iron industry by forcibly stopping Chinese laborers in the limestone quarries ; monopolization of the Soya bean crop in the hands of Chinese official companies ; issue of billions of unsecured paper currency and many other activities designed to injure Japan's vital economic and strategic position are merely evidences of a settled policy on the part of the Chinese to drive Japan out of Manchuria.

Privately, the Chinese frankly admit the objects behind their campaign yet for the past ten years, Japan has preached co-operation, conciliation, friendship, understanding and goodwill towards China, based on the doctrine of co-existence. Every new President of the S.M.R. enters upon his duties imbued with the hope that the Chinese will recognize Japan's disinterested friendship. They harp on the fact that Manchuria is an integral part of China and in every way try to convince the Chinese of their good intentions. But all this makes no impression on the Chinese who will never be satisfied until Japan has evacuated Liaotung and handed over to them the wealth she has created. When Japan is forced out of the mainland, the Chinese will be satisfied.—G. B. R.

Soviet Second in Tractor Manufacturing

Mr. Ossinsky, Chairman of the Soviet Council of the Automobile and Road Building Society gives the following data on tractor manufacturing in the U.S.S.R., for the first six months of the current year.

The U.S.S.R. he writes, now occupies second place in the world in the production of tractors. This is shown by figures taken from the past six months of production at the Putilov plant in Leningrad and the Stalingrad plant.

Last year the Soviet Union ranked third having produced 13,400 tractors and ranking second after the Cork Fordsons plant in Ireland, which turned out 17,000.

During the first six months of the current year the Putilov and Stalingard plants together produced 14,344 tractors, that is 1,000 more than during the whole year of 1930 or 34 per cent of the total Fords' production in Ireland for the past year. The Soviet Union has thus brought its monthly production to 3,500 tractors. This total is to be increased in the future since the present tractor plants are to be better equipped and the Kharkov plant is to be put into operation this year ; the yearly output will considerably surpass that of the Ford plants in Ireland.

The Soviet Union thus having achieved second place in the production of tractors will now compete with the United States of America, the motherland of tractor manufacturing.

New Air Services for Japan

The Japan Air Transportation Company has announced a plan to initiate a one-day passenger service between important cities of the country.

As a beginning the service between Tokyo and Kagoshima, Kyushu, 1,500 kilometers, will be opened. A passenger seaplane will hop off from Suzugamori, in the suburb of Tokyo, early in the morning and will arrive at Kagoshima at noon, returning to Tokyo in the same day.

The next routes for the similar service are, Tokyo-Horouchi (1,000 kilometers), Tokyo-Odomari (1,300 kilometers), and Tokyo-Chichijima Island (1,000 kilometers).

Shanghai Waterworks Extensions

By H. STRINGER, B.A., A.M.Inst.C.E., M.I.Mech.E., Deputy Engineer-in-Chief

THE International Settlement of Shanghai is a city of about one million people and its water supply is taken from the Huangpu River on which it is situated. This water has an average turbidity of 223 and an average bacterial content of 80,635 at 20° C. and 50,072 at 37° C. Shanghai, therefore, is in the unenviable position of having one of the most turbid and probably the most polluted sources of water supply in the world. The purification of such a source of supply consequently presents a many-sided problem quite apart from the abnormal growth in water demand.

Demand

As shown by Curve 1 the year 1920 was remarkable for a very much increased upward tendency in the *per capita* consumption (for all purposes) of water in the Settlement. In that year it was demonstrated that the old methods of draw and fill and settlement by gravitation only, could not provide water of a quality which the slow sand filter beds could sufficiently purify at the rates demanded of them. As a consequence, coagulation was adopted, imported aluminum sulphate with a 17 per cent aluminum oxide content being used for this purpose.

The high rate of increase in water demand persisted and in 1924 it became apparent that increased capacity, both in settlement and filtration, was required.

An extensive reconstruction program was consequently put in hand in 1925 after small scale experiments had been made in methods of continuous settlement and rapid filtration.

New Construction

As an introduction to a description of the extensions which have taken place in the period 1925 to 1930, it should be stated that water is pumped from the river to settling tanks, pumped to rapid filters and finally pumped to the town mains. The three stages of pumping are known as Primary, Secondary and Main. Slow sand beds are practically all fed by gravitation from settling tanks.

Intakes

Increased settlement capacity, of course, implies the provision of more river water and, in order to provide this, an outshore intake was constructed in 1925. This is shown under construction in photographs Nos. 1 and 2, the cylinder being of steel and ten feet in diameter and the connecting steel flanged pipe 60 inches in diameter by 170 feet long. The cylinder in 45 feet long and sunk 18 feet below river bed, this depth being required owing to a future dredging scheme of the Conservancy Board. It was sunk by dredging a foundation before pitching and then excavating through doors in a diaphragm fixed seven feet above the cutting edge. On completion of the excavation the space below the diaphragm was filled with concrete. The connecting 60-in pipe was assembled on shore, slung by a floating crane and dropped through guides into a previously prepared dredged channel, the bolting up being done by divers. The capacity of this intake with one foot loss of head is about three million gallons per hour.

In 1929 additional settlement was required and the construction of a further intake was put in hand. Two factors were responsible for a change in design. The first was the possibility of a ship out of control colliding with and damaging an intake of the type just described. The second was limitation of settlement in the pump houses which occurred due to the dredging of the deep channel required for the installation of the connecting pipe, mentioned above.

For these reasons an inshore type of intake was adopted with a dredged channel 20 feet wide with heavy eight inch timber birds-

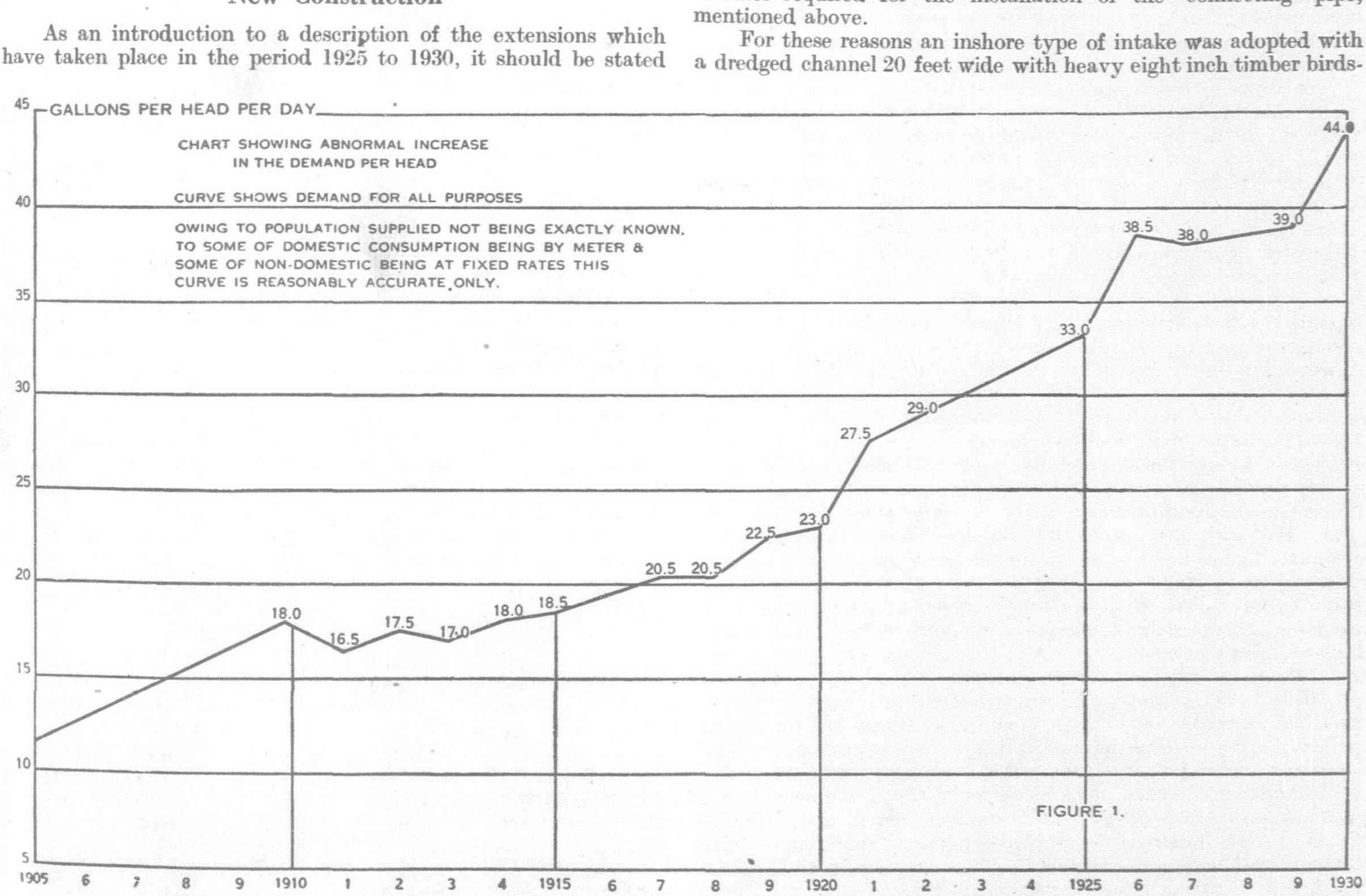


FIGURE 1.

Chart shows the tremendous increases in Water Consumption in Shanghai from the Year 1905

mouth sheet piling to its sides for a length of 45 feet towards deep water. Bottom levels were fixed to give 10 feet of water at lowest tides. The new intake is fitted with two motor driven vertical revolving screens of $\frac{3}{4}$-inch square mesh each capable of passing two million gallons of water per hour at a velocity of two feet per second. These screens which are six feet wide, are housed in two rectangular reinforced concrete twin wells each 7-ft. 2-in. by 11-ft. 0-in. long, which are connected by two 42-in. pipes to the pump wells. Considerable constructional difficulty was encountered here owing to damage to two of the sheet steel piles which formed the coffer-dam. With under water pressures of about 18 feet, four serious foundation blows occurred as would have been expected with mud with a sand content of 72 per cent. This difficulty was got over by a sand bag dam outside the sheeting laid on tarpaulins the bottom width of this being 10 feet. Photograph 3 and 4 show the general appearance of the new intake and the revolving screens.

Pitching of Outshore Intake Cylinder 45-ft. londg by 10-ft. diameter

The total intake capacity of the plant is now $8\frac{1}{2}$ million gallons per hour, and this will shortly be increased by a further million and a half on the construction of a further inshore intake on the lines just described above.

Continuous Settlement Tanks

The success of this method, of course, depends on adequate mixing of the alum dose, accurate regulation of the water velocities in the tank and correct slopes to the mud pockets which will ensure flow of the deposited mud through the pipes connected to the mud pump. The general arrangement is shown in photographs 5 and 6 the first of which shows the mixing chamber and the second the hopper pockets for mud collection. The velocities adopted through the tank are as below :—

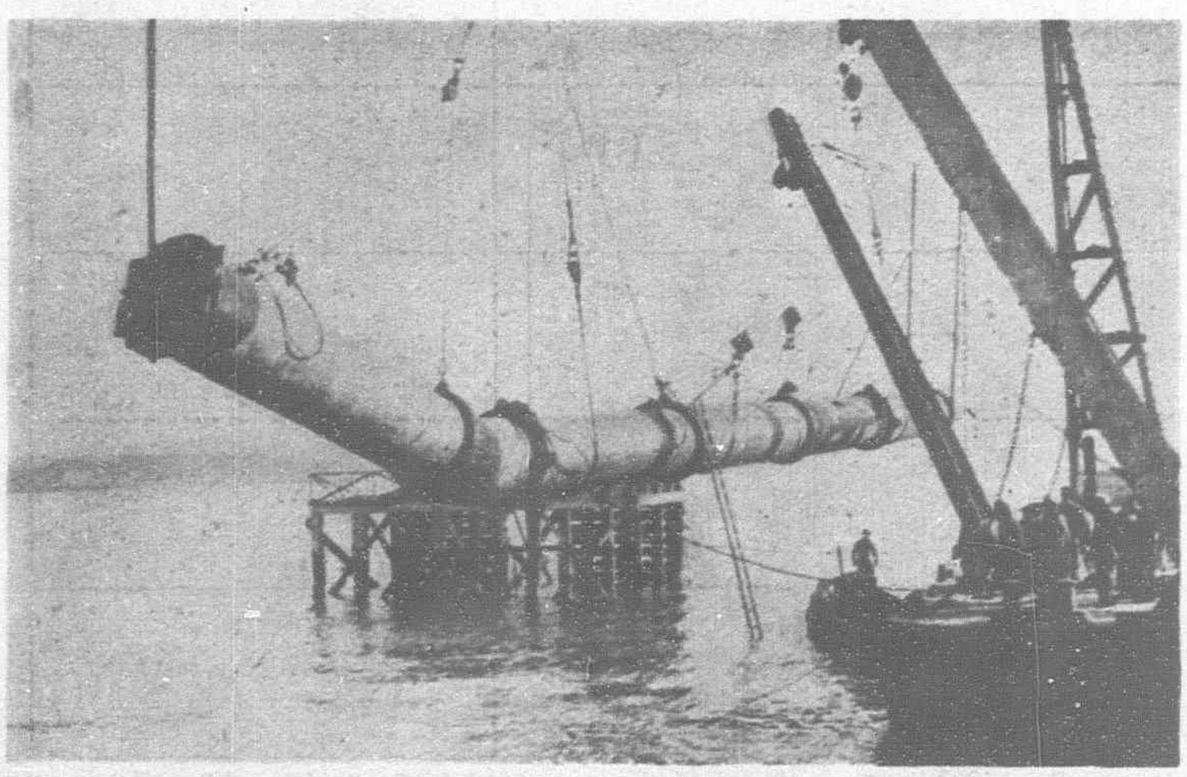
Mixing chamber 6.36 inches per second. Mixing time of 14 minutes with six channels.

Tank 1.00 inch per second giving a contact period of 80 minutes.

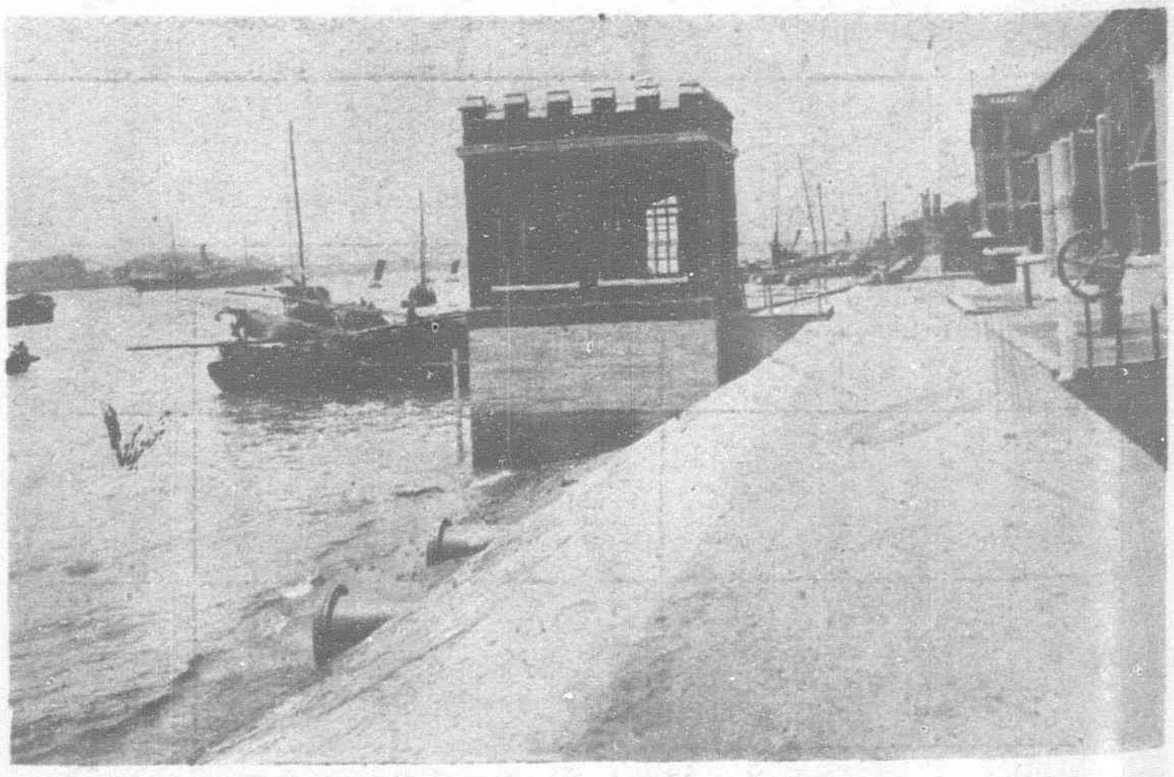
To obtain this contact period the tank is baffled by a central wall.

Factors Influencing Design.—As continuous settlement would give three times the quantity of water than that given by the old method of draw and fill with a maximum period of six hours quiescence, conversion of the old tanks was obviously indicated. This could be carried out piecemeal during the winter when demand was low, a more ambitious program being forbidden by the fact that periods of quiescence had fallen as low as half an hour during maximum demand in the summer months.

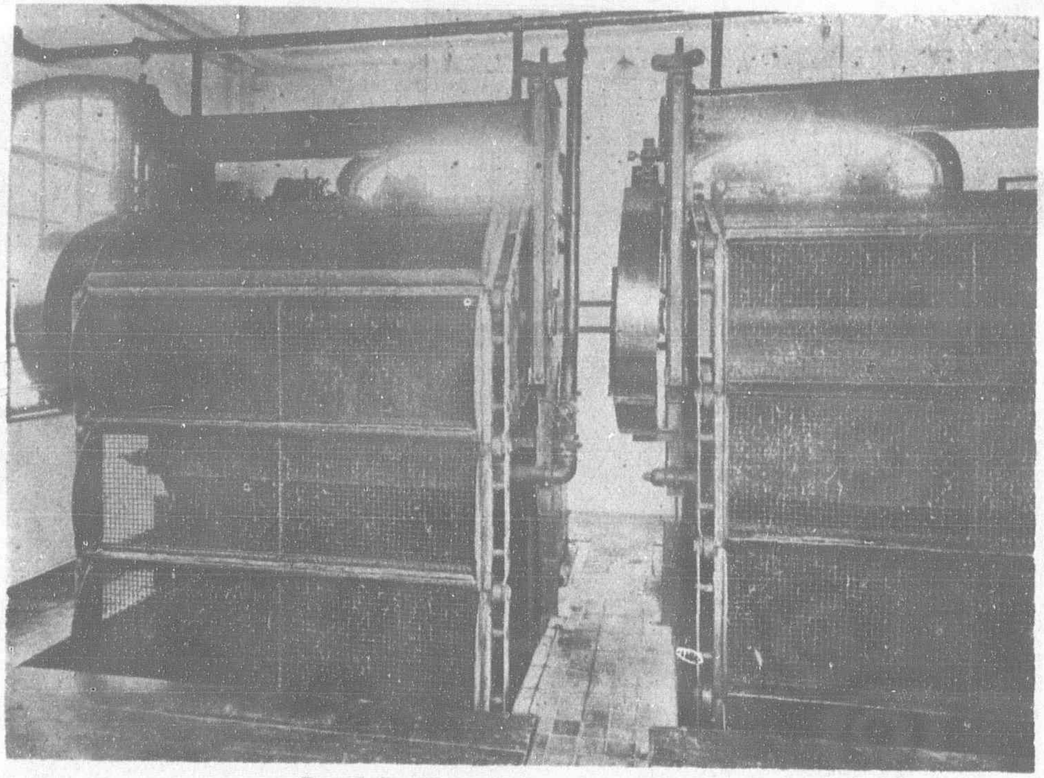
With the adoption of continuous settlement the problem of continuous mud removal was inevitably bound up as a deposition of mud at three times the rate under the old method of working would have tied up the tanks at too frequent intervals for cleansing by hydraulic sluicing, as this method closed down each of the tanks when worked under draw and fill conditions for a fortnight to three weeks, depending on the size of the tank in the spring and autumn of every year. Photograph No. 7 shows a tank being cleaned by this method.



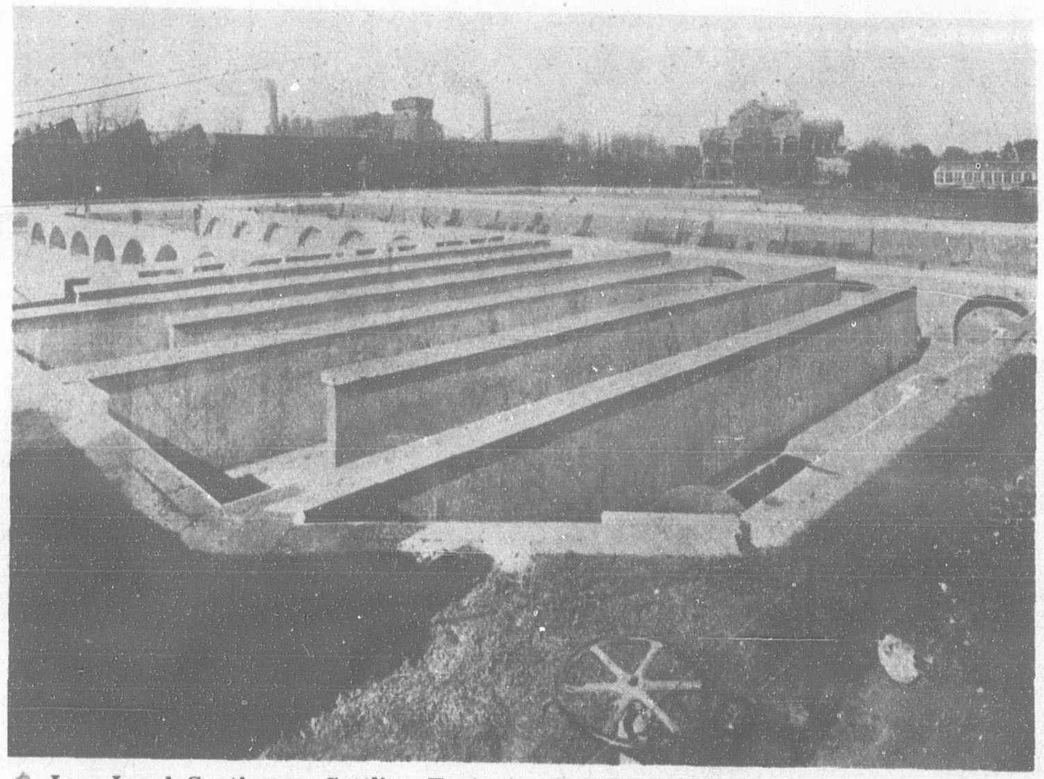
Outshore Intake shewing 170-ft. by 60-in. steel connecting pipe being lowered into dredged channel



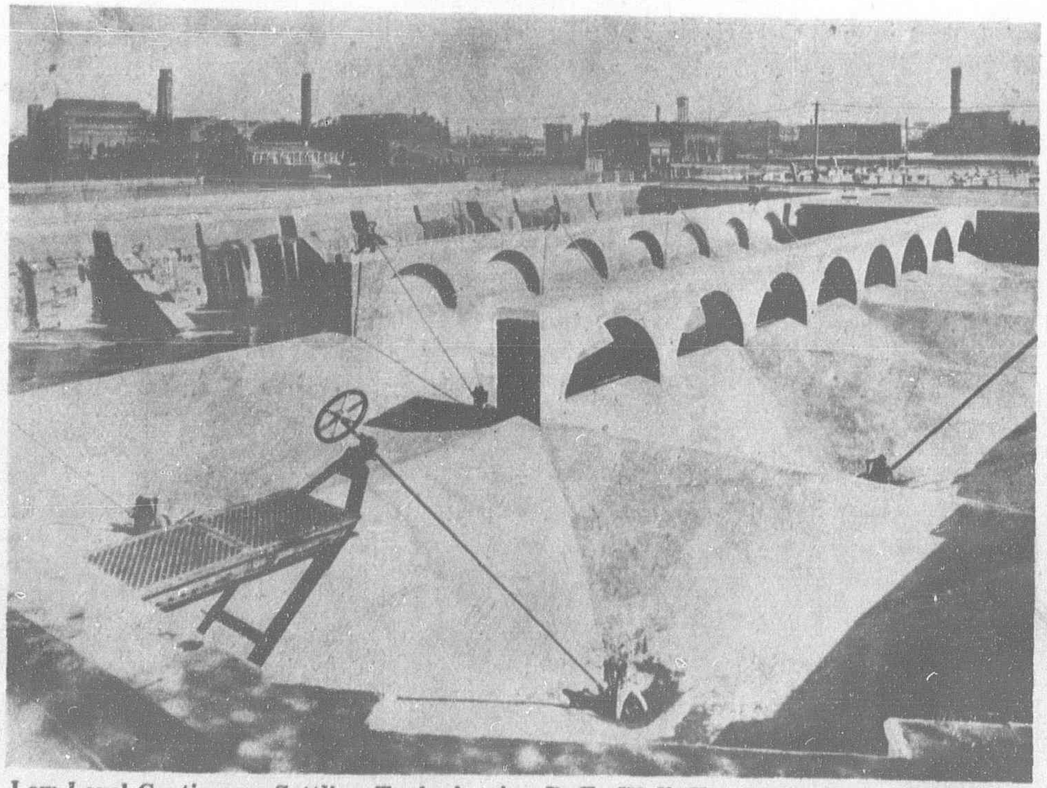
General appearance of Inshore Intake



Revolving Screens for Inshore Intake

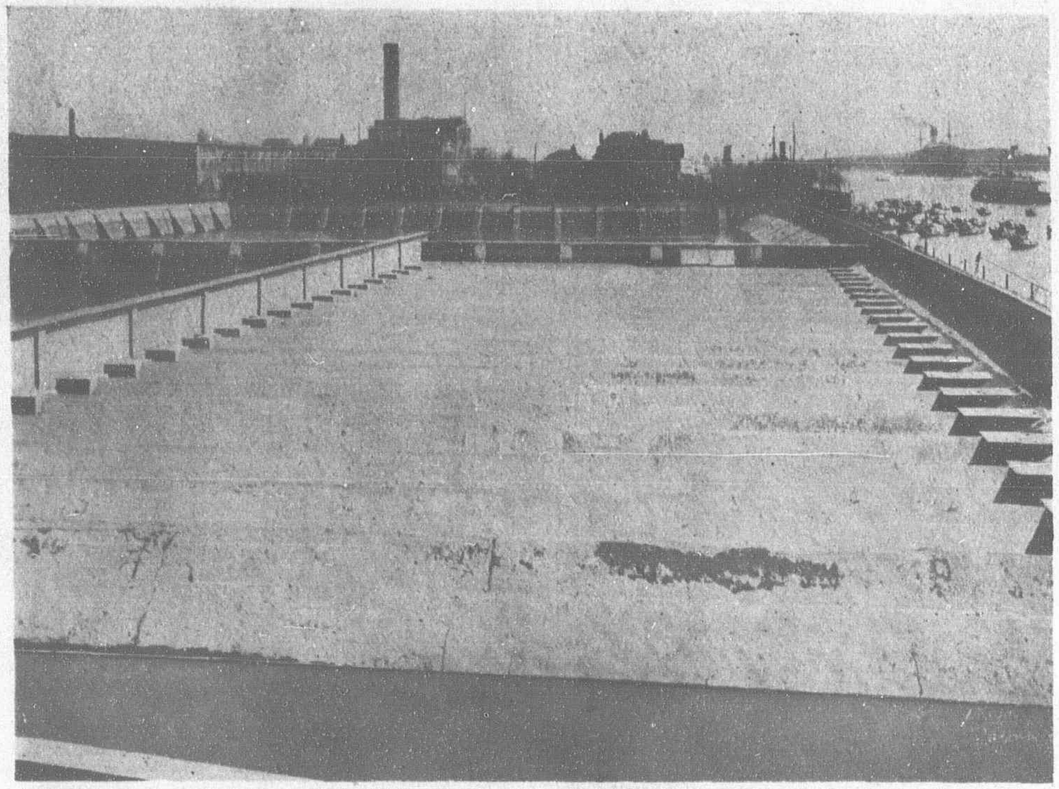


Low Level Continuous Settling Tank shewing Mixing Chamber and Baffle Wall

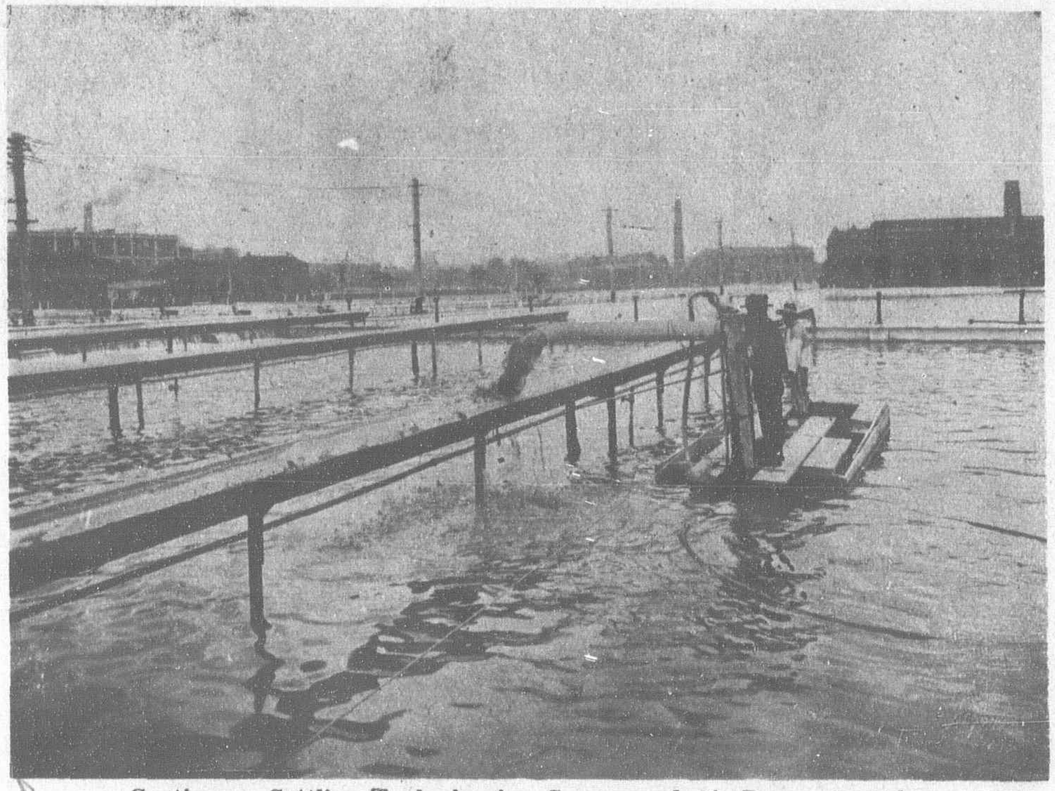


Low Level Continuous Settling Tank shewing Baffle Wall, Hopper Pockets and Valves

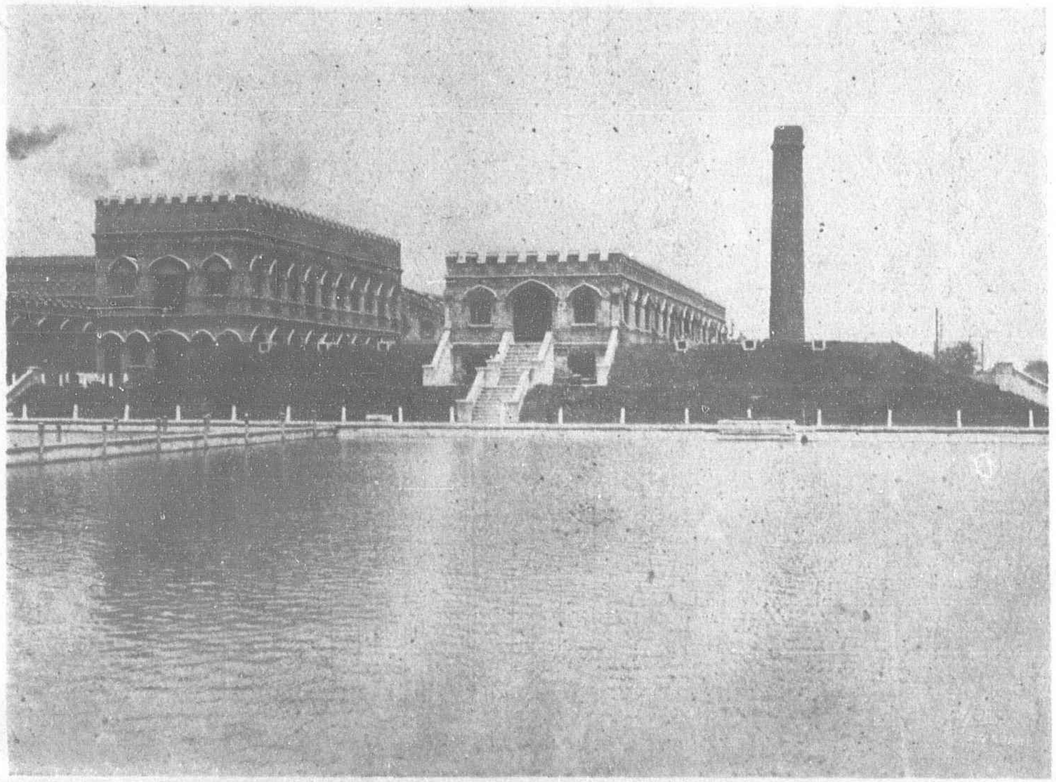
Cleaning intermittent settling tank by hydraulic sluicing to mud pump



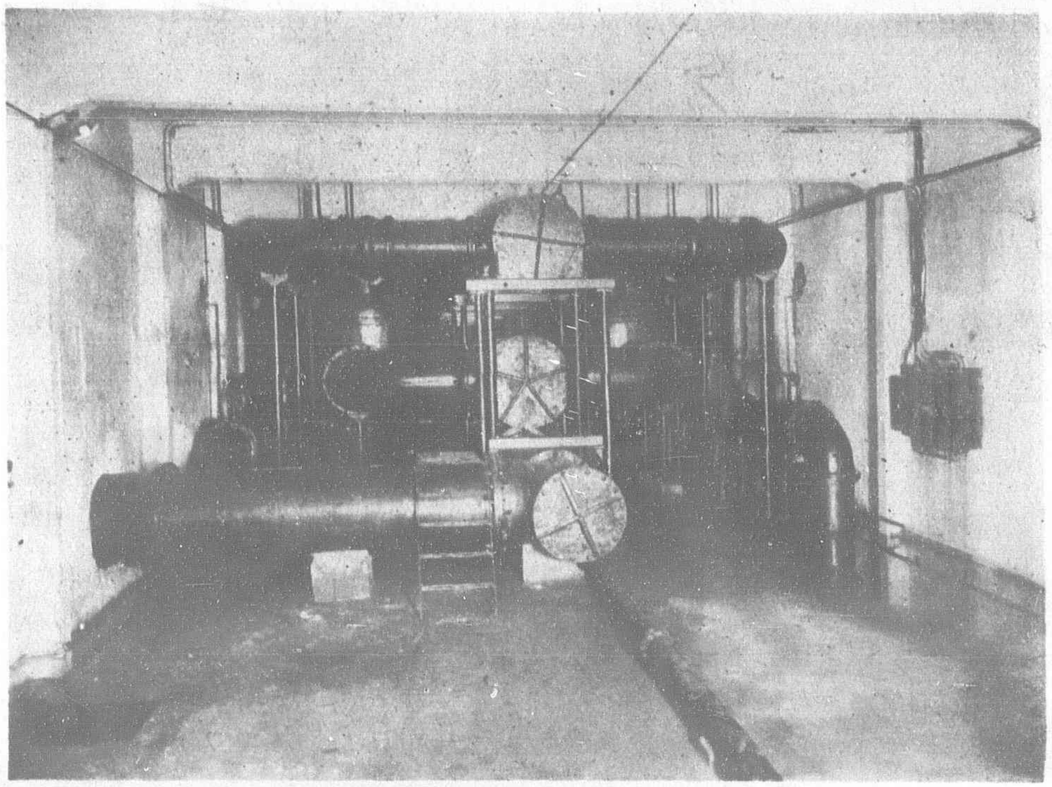
Continuous High Level Settling Tank shewing Gravity Mud Collecting Channels for River Discharge



Continuous Settling Tank shewing Compressed Air Pump at work



General Appearance of Rapid Filter Battery with Wash Water Tower to left



Rapid Filter Pipe Gallery

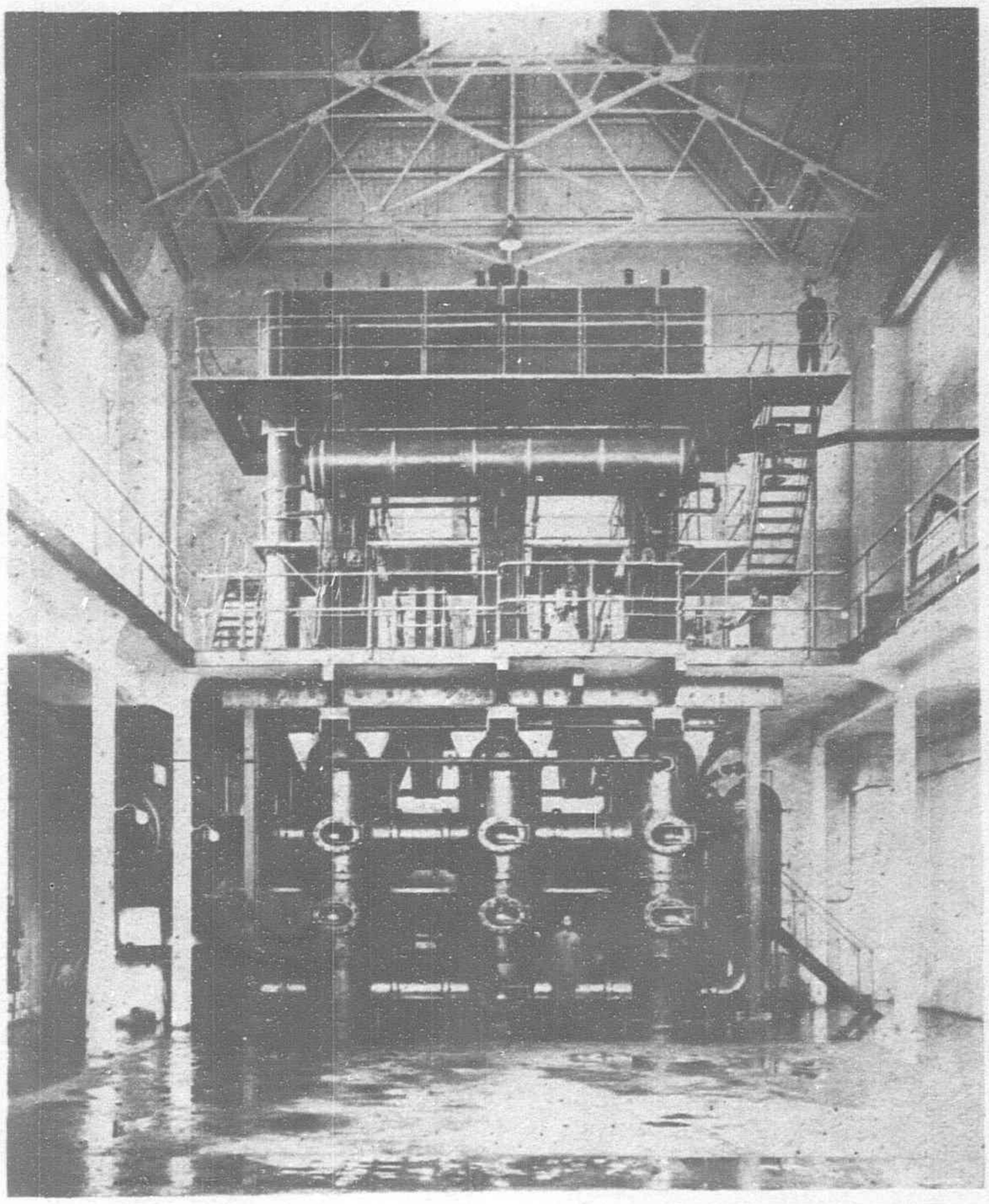
The factors influencing design of the first mud removal system were, firstly, the impossibility of gravity sluicing to the river with the existing tanks. These tanks were 16 feet deep and, even if raised to the minimum depth of 10 feet required for continuous settlement, certain stages of the tide would have rendered gravity sluicing inoperative. As a consequence it was necessary to adopt mud pumps. A second factor in design was the physical properties of the deposited mud. With a mud with a 40 per cent dry solid content the angle of repose ranged between 10 to 15 degrees while, with a 75 per cent dry mud content, angles of repose vary from 24 to 19 degrees with increasing pressure. Experiments with regard to angle of repose were carried out with the water pressure conditions which would obtain under working conditions, and as a result of these a slope of 20 degrees was given to the mud collecting pockets. In practice, however, these slopes proved insufficient and mud has to be assisted down these slopes by hand-operated shoes

The following are the general dimensions :—

Tank 256 by 150 by 16 feet deep.
Main Baffle Wall 199 feet.
Six Baffles in Mixing Chamber 10 feet centers.
Mud pockets 36 feet square with slopes to central valve of 20 degrees. These slopes were formed of four to one lime and mud filling with a 4-in. thick skin of concrete on top.

PIPING :—Four mud pump collecting pipes of 9-in. diameter connecting with a 9-in. manifold housed in a 9-ft. wide culvert to allow of rodding the pipes through hatch boxes.*

The work was carried out in the case of No. 2 Tank† in 1926 and a similar tank, known as No. 1 Tank, was converted to the same use in 1929. The conversion of this latter tank was similar in design except that mud pockets were omitted on the outlet side of the baffle wall as it was found that 95 per cent of the mud was deposited in the first half of the tank. This effected a saving of 14 sets of valve gear with the necessary collecting pipes. It was also found in practice that the mixing channels silted up until an approximate channel area of 60 square feet was attained with a velocity of 12-in. per second. Depth of mixing channel was thus reduced to 6-ft. below working level.



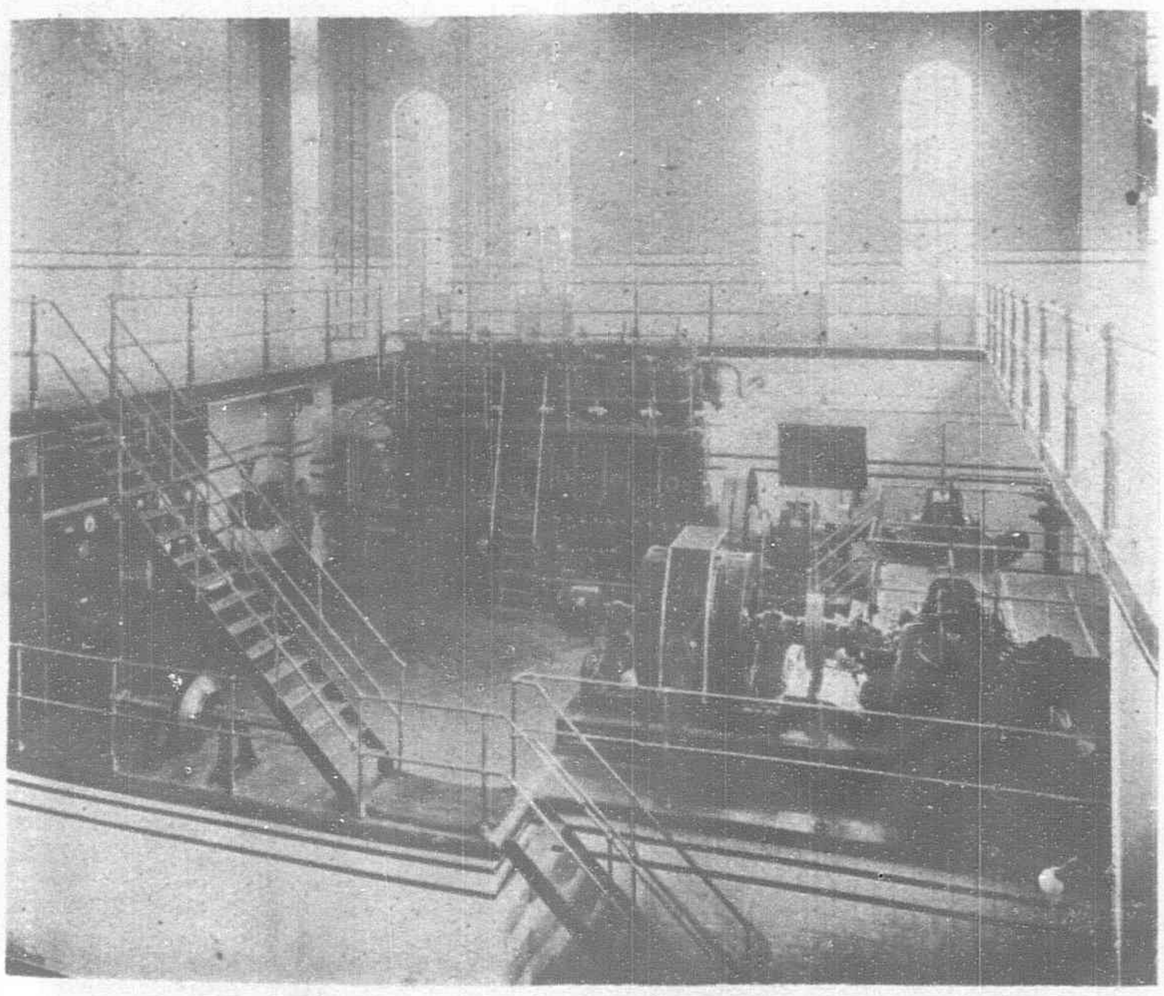
Triple Expansion Single Acting Main Pump, capacity 600,000 gallons per hour

These two tanks, worked at the above rates, each give 1,500,000 gallons per hour of settled water with a turbidity of 50 at outlet. The effluent from both these tanks is passed through a third tank where an extra contact period is obtained. The final turbidity is by this means decreased to 30 on delivery to the filter beds. The velocity in this tank is 0.5-in. per second, giving an additional contact period of 100 minutes.

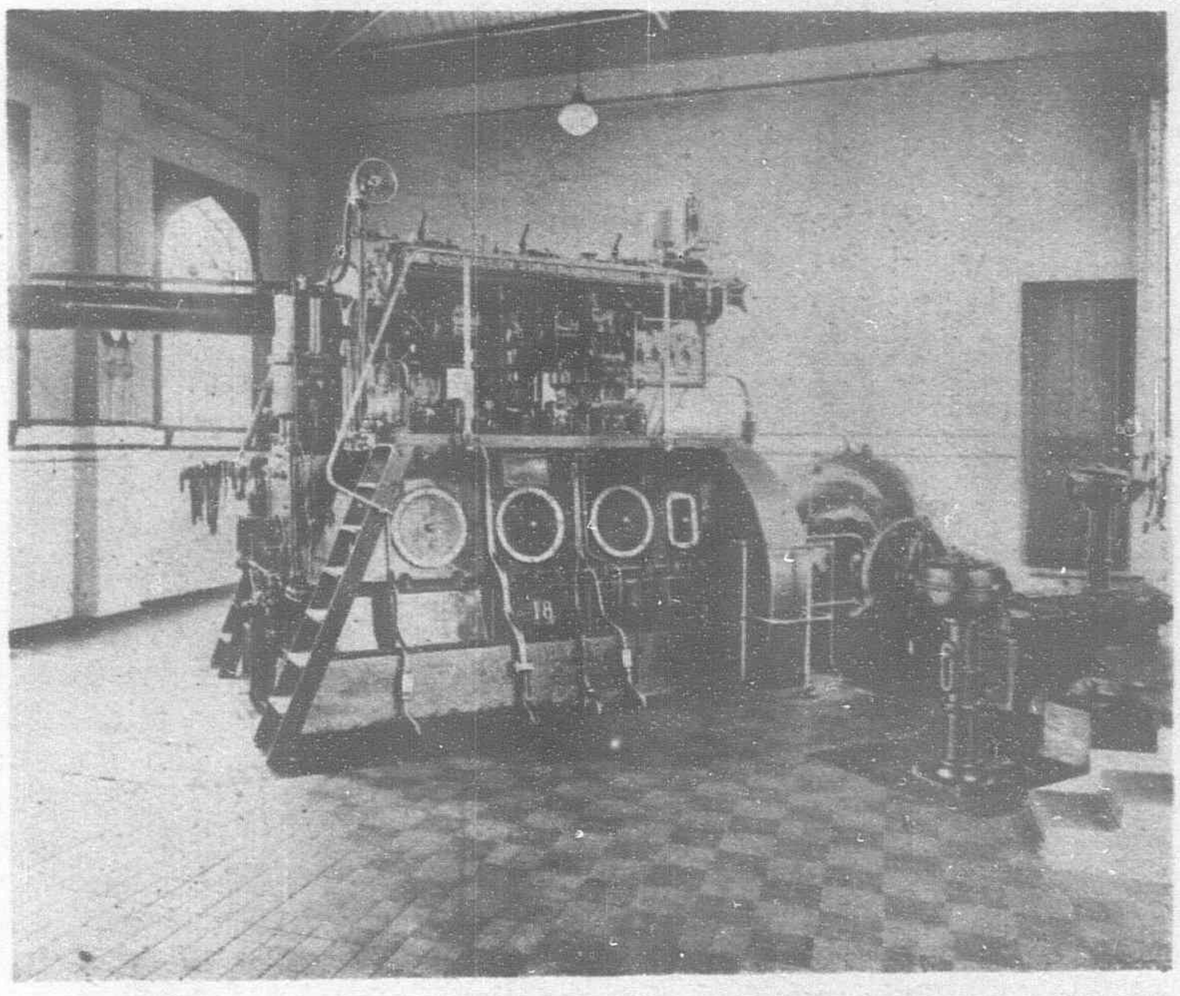
This tank, which is 247 feet by 200 feet wide and 16 feet deep, was provided with a central wall in 1926, 247 feet long, dividing the tank into two, so that one half of the tank could be put off for cleaning. This wall was constructed in reinforced concrete, the wall being "T" shaped in section with a base width of 14-ft. by 1-ft. 7-in. thick, the wall thickness being 2-ft. at the base and 8-in. at the top where a 3-ft. wide platform was provided.

Further continuous settlement capacity was also provided in 1927 as the result of the necessity to repair the gravity dam which formed one of the walls of the settling tanks, known as 5 and 6.‡

* These have never been required in practice.
† See General Plan.
‡ See General Plan.



Single Stage Main Pumps, with two-cycle Diesel and Motor Drive, capacity 600,000 and 660,000 gallons per hour respectively

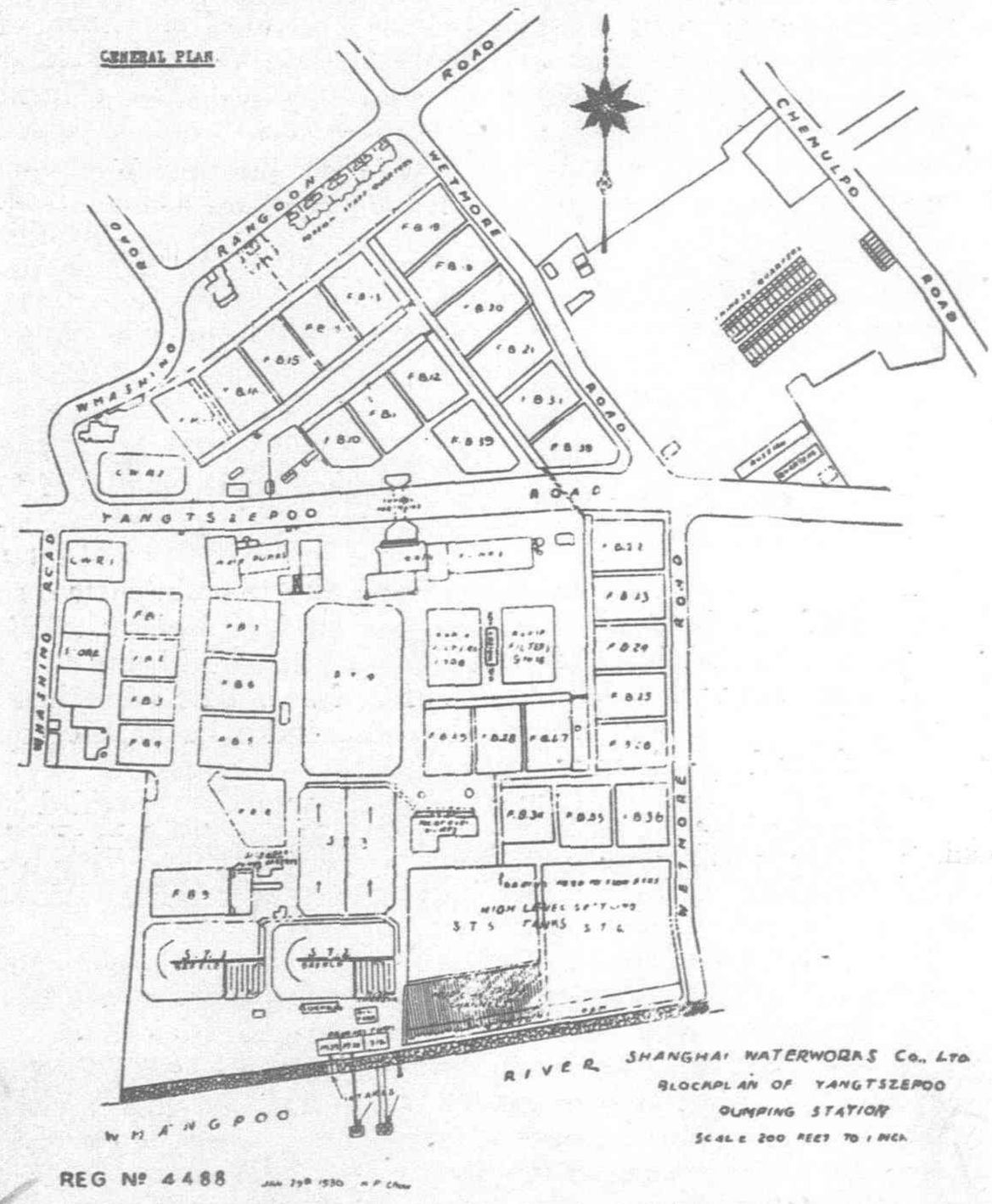


Low lift, single stage centrifugal pump with 4-cycle Diesel drive

As these dams developed serious leakage at levels of 14-ft. and had a working level of 18-ft., it was decided to eliminate secondary pumping from settling tanks to filter beds by raising the dam level to admit of a working level of 22-ft. thus providing a gravity feed from settling tanks to slow sand filter beds which have a maximum demand of 1,500,000 gallons per hour. The dam was light in section with slopes of 1 to 1.75 and a 10-ft. top width, but it was stable enough for the conditions required.

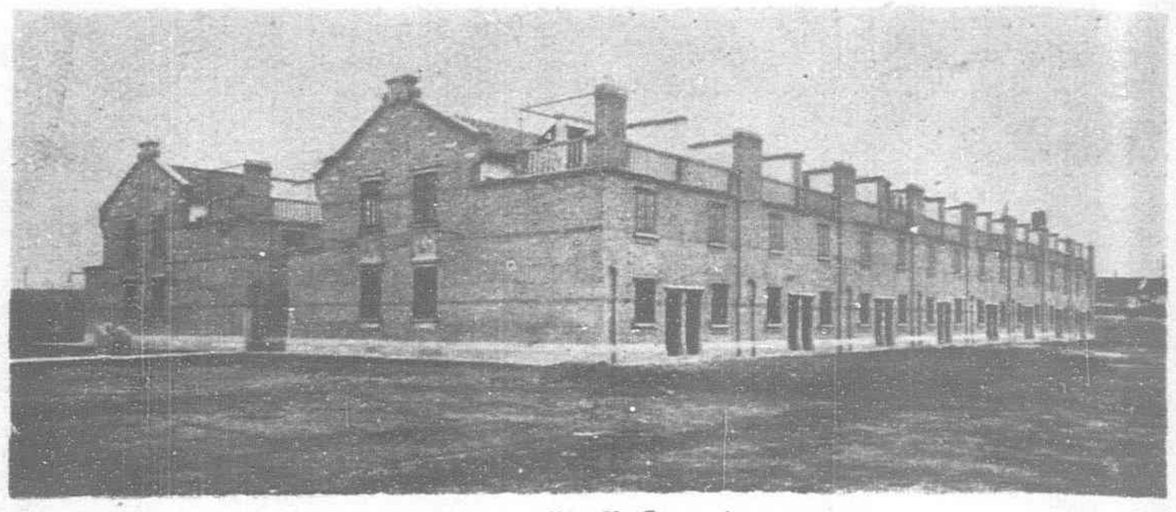
It was, therefore, decided to try and eliminate leakage by removing the pitched face and replacing it by a 6-in. thick skin of reinforced concrete. As the clay of the dam was found to be in excellent condition, this skin was designed for waterproofing purposes only, its strength in shear being only equivalent to a plaster of mud 3-ft. thick up the face of the dam. As an additional safeguard to counteract any danger of upward pressure, the top of the dam was sheeted with 15-ft. by 4-in. birdsmouth sheet piling. Expansion joints in the 6-in. skin were at intervals of 50-ft. and these were made in sheet zinc.

Further in order to check leakage and to improve conditions in the rather weaker sections at the base of this dam, it was decided to add a plaster of mud rammed in 6-in. layers, the top level of



this being 10-ft. above tank bottom and with a slope of two to one. Since this was done, leakage has progressively decreased and moved downwards and is now almost negligible. The dam has been in continuous use since the spring of 1929 and has resulted in an annual saving in secondary pumping of Tls. 15,558.00 (£1,321 or G.$6,455).

In other essentials the principles of design are the same in this tank as in Nos. 1 and 2 Tanks, but in this case a different method of mud removal was adopted owing to the higher working level of the tanks and the possibility of frequent gravity sluicing into the river. The suspended matter here settled into a series of 23 channels, each 103 feet long placed at right angles to the direction of flow. These channels at 12-ft. centers are triangular in section, 5-ft. 6-in. deep with 45 degrees slopes. The bottom width of the channel is 9-in. and this is pierced at 3-ft. intervals with 1-in. diameter holes through which the mud flows to a 6 by 6-in. collecting channel underneath. These channels have a fall of 6-in. and are closed by 6-in. valves at their junction with a concrete manifold 1-ft. wide by 1-ft. deep with a fall of 1 in 75. This manifold conveys the mud to two 20-in. pipes which go through the dam to the river 6-ft. above tank bottom.



Chinese Staff Quarters

In order to keep the mud in motion when sluicing, each channel is provided with a set of hand-worked scrapers. This method of mud removal, which was adopted as a result of lengthy experiments, has not as yet proved an entire success and an air lift pump fixed to a float has been used to supplement the gravity sluicing. This pump delivers into triangular wooden channels fixed to the ridges of the existing mud removal channels. Photographs 8 and 9 show the general appearance of these tanks and the compressed air pump at work.

GENERAL DIMENSIONS.

No. 5 Tank : 350-ft. by 280-ft. by 22-ft. 6-in. deep.
No mixing chamber as water falls over a weir into tank.
Length of baffle wall 280 feet.
Number of mud collecting channels : 23.

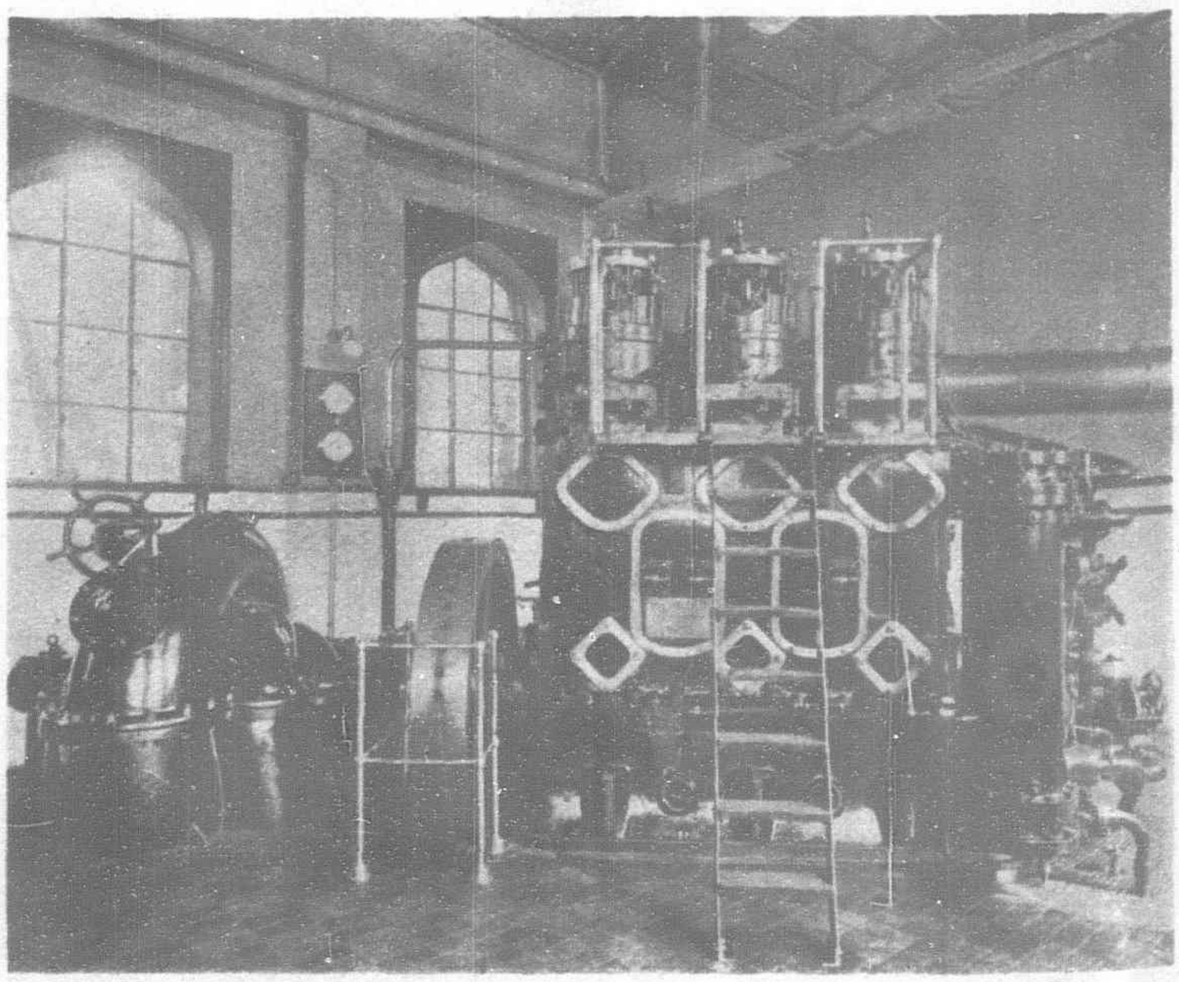
No. 6 Tank : 320-ft. by 280-ft. by 22-ft. 6-in. deep.
Future baffle wall extension of above, 190 feet.
Future number of channels : 13.
Velocity at inlet 0.75-in. per sec.
Velocity at outlet 0.16-in. per sec.
Settlement period 6½ hours.
Capacity 1,500,000 gallons per hour.

This completes the description of major works relating to settlement, the capacity for which is now 4,000,000 gallons per hour, and the future capacity 6,500,000 without further alterations to the plant as it stands.

COSTS.

	Working Tls.	*Capital Tls.*	*Total Tls.*
Estimated cost per million gallons of discontinuous mud removal in 1927	0.408* (G.$0.169) (£0.0.8½)	0.545 (G.$0.226) (£0.0.11)	0.953 (G.$0.395) (£0.1.7½)

* This figure is the actual cost of removing mud by hydraulic sluicing after the settlement of 5,866 million gallons in Nos. 5 and 6 Tanks using steam pumps in 1927. Electric pumps would have reduced this to Tls. 0.251. The time taken was 21 days for No. 5 Tank and 28 days for No. 6 Tank.



Low lift, single stage contrifugal pump with 2-cycle Diesel drive

	Working *Tls.*	*Capital* *Tls.*	*Total* *Tls.*
Estimated cost per million gallons of continuous mud removal in 1927 (in No. 2 Tank)	0.166 (G.$0.069) (£0.0.3¼)	0.590 (G.$0.245) (£0.1.0)	0.756 (G.$0.314) (£0.1.3¼)

Actual working cost of continuous mud removal in 1929 was Tls. 0.136 per million gallons. Mud disposal also involves the Company in additional expense as payment has to be made for dredging the material pumped back into the river. This added Tls. 0.417 per million gallons to settlement costs in 1929 at 41.2 per cent load factor approximately.

Total settlement cost per million :

1930—Tls. 6.45 (£0.11.0. or G.$2.67).
1929—Tls. 5.65 (£0.9.7. or G.$2.34).

Filtration

Apart from other considerations the abnormal increase in land values, and the dilatory methods of conducting land deals in the Chinese manner, practically compelled the adoption of methods of rapid filtration. In this process the usual rate of working filters is 100 gallons per square foot per hour as against a maximum of five and an average of about two in slow sand beds. Thus, though the capital cost in 1923 of slow sand filters was only Tls. 1.85 per square foot as against the cost of Tls. 26.70 for the rapid filters constructed in 1925, the capital cost for equal capacity of slow sand beds would have been at least Tls. 100.00, quite apart from cost of land if it could have been obtained in time.

The operation cost of rapid sand filters is, however, higher than that for slow sand beds, Tls. 2.58 per million gallons as against Tls. 3.59 in 1929. The average demand in 1929 on rapid filters was 411.6 millions, *i.e.* 57.2 per cent load factor, giving an extra operating cost of approximately Tls. 5,000.00 per annum, which adds, at 7 per cent, a further capital expenditure of Tls. 71,500.00 to rapid filtration, which brings the cost per square foot up to Tls. 33.25.

Rapid Filters

Two batteries of eight rapid filters have been constructed since 1925, both of the same capacity—one million gallons per hour. Generally the designs are similar, but in the battery constructed in 1925 experience showed that our expectation of algal growth on these filters would not be realized and that these need not be covered. This alteration admitted of raising the reservoir capacity beneath the filters to 750,000 gallons, as against 500,000 gallons in the first battery giving a longer contact period for chlorination with consequent improvement in the bacterial quality of the effluent. Further, some simplification in piping and saving in valves resulted in the adoption of a Larner-Johnson two-way valve instead of individual valves for influent sewer, wash water and effluent pipes. Again, as a result of our experience of foundation settlement in the first battery, the eight new filters are designed as four independent units of two filters each, while the pipe gallery and operating floors between each set of four filters are entirely independent units. A further improvement was the substitution of steel and corrugated iron for concrete in the roof of the operating floor.

Lastly, in order to admit of isolation of each set of rapid filters the effluent channels were built in duplicate. Opportunity was also taken of utilizing the column system necessary to support the central wash and sewer pipes in the pipe gallery to support the operating floor above.

The following is a dimensional description of the work :—

The whole building in plan consists of three independent units constructed on separate foundations : two reinforced concrete reservoirs on east and west sides, each 159-ft. 2-in. long, 40-ft. 8-in. wide and 12-ft. high, inside dimensions, with four reinforced concrete filters on top of each reservoir, poured in two separate units consisting of two filters each. All filters are 40-ft. by 41-ft. 6-in. center to center of walls by 8-ft. 3-in. high, *not* covered on top. In the center is a reinforced concrete clear water chlorine contact chamber 159-ft. 2-in. long, 26-ft. wide and 8-ft. 3-in. high, with reinforced concrete pipe gallery above, on top of which is the operating floor 159-ft. 2-in. by 27-ft. by 9-ft. 10-in. high to the bottom chord of the roof truss.

Operating floor walls are 10-in. brick walls in cement mortar, with buttresses at 32-ft. centers. These walls are laid on the top of reinforced concrete filter walls on east and west sides and on top of the pipe gallery walls on south and north sides.

As the efficiency of operation depends almost entirely on the arrangements for backwashing, the following details as to the combined under-drainage and backwash system are attached.

Each filter has an area of 1,400 square feet and is divided into two halves 41-ft. by 17-ft. 2-in. fed by a central duct, 3-ft. 6-in. wide with a clear water duct underneath 3-ft. 6-in. by 2-ft. 6-in.

The under-drainage and backwash system is designed to what is known as the " Illinois Standard."

Venturi type rate controllers and loss of head gauges are employed for the regulation of the filters.

As regards rapid filter sand, in the case of The Shanghai Waterworks, the ordinary slow sand filter yields 44 per cent of a sand within the required limits, its effective size being 0.44 millimeter in diameter, the size of sand which gave 60 per cent finer than this size being 0.80 its uniformity coefficient thus being 1.82.

Sand of suitable quality is then obtained by rejecting that which was retained on a sieve with 18 meshes (1.15 millimeters) to the inch and keeping that which was retained on a 40 mesh to the inch screen (0.43 millimeter). The coarse sand retained on the 18-mesh sieve is then re-screened through a 10-mesh sieve (2.10 millimeters) and that which is retained rejected while that which passes and is retained on the 18-mesh sieve is kept. After screening the filter is filled with 2-ft. 3-in. of the first sand and 3-in. of the second, the complete filtering medium being as below :—

			Quantity for 1 Filter.
Sand	2'3"	18-40 mesh	3,150 cubic feet.
	3"	10-18 ,,	350 ,,
Gravel	3/16"—1/10"	3"	350 ,,
	3/8 "—3/16"	3"	350 ,,
	5/8 "—3/8"	3"	350 ,,
	5/8 "—1"	4"	467 ,,
	2-1/2 "—1"	5"	583 ,,

The details of the piping which feeds and drains the filters are as below :—

Influents for settled water 20-in. in diameter.
Sewer for wash water 36-in. with 30-in. tees to filters.
Wash water pipe 30-in. with 24-in. tees to filters, and 18-in. to clear water chlorinating chamber.

This is designed to supply 27,400 gallons per minute with a head of 40 feet from a wash water tower of 165,000 gallons capacity —90 feet by 30 feet by 10 feet—giving ample water for a six minute wash.

All piping passing through water bearing walls is fitted with puddle flanges and the concrete round all such castings is specified as 1 : 1 : 2. Photograph No. 10 shows the general appearance of a rapid filter battery with wash water tower to left. Photograph No. 11 shows the pipe gallery and system of piping with raw water mains on top, sewer in the middle, wash pipe, clear water and rate controllers on the floor.

As regards operation of these filters they have been uniformly satisfactory. The rate of working is 110 gallons per square foot per hour, and filters are washed at a 6-ft. loss of head, but always once in twenty-four hours, the percentage wash water used averaging 3.62 per cent. for 1930. The bacterial reduction from river to filter effluent is 99.51 per cent and after chlorination at the filters 99.99 per cent Prechlorination was introduced in the summer of 1929 and this has reduced the bacterial load on the filters by 90 per cent with consequent further improvement in the effluent. The average dose used is 0.5 parts per million. Chlorination is also used on all suctions of the main pumps the average dose being 0.2 parts per million.

General

This completes the description of the major extensions, but much additional work has been carried out on engine house extension and engine foundations. As regards general principles influencing local design the following factors are perhaps worthy of notice.

B Coli are present in the local soil and every precaution has to be taken against leakage in water bearing structures.

Owing to the possibility of deeper local excavation and the fact that the local mud is known to flow under certain conditions of pressure at angles as low as 10 degrees, the principle of rafting which prevailed previous to 1925 has been abandoned and all structures are now piled, an adhesion of 300 pounds per square foot for squared and 250 pounds for tapered piles being adopted, the usual impact formulae being inapplicable. Loads without settlement up to 430 pounds per square foot have been applied.

Except in the case of engines piling takes the balance of load over 1,000 pounds per square foot. In the case of engines the whole load is so taken. In the case of a tunnel for three 40-in. mains under the main road which divides the Company's property, soil load was limited to 600 pounds per square foot as settlement in this area would have been a serious matter.

All wells, towers or other structures likely to be submitted to earth and water pressure are constructed in 1 : 2 : 4 reinforced concrete, a slab of rough concrete 1 : 3 : 6 being always put under such work for convenience of cleanliness, setting of reinforcement and drainage. Earth pressure on walls is calculated on the assumption that they are to contain a liquid pressure of a density of 25 pounds per cubic foot. Steel sheeting is used wherever possible for foundations. In deep excavations where water in considerable quantity is expected bearing piles are driven with a dolly through the last 5 or 6-ft. of mud before excavation.

Small balancing towers up to 12-ft. diameter are constructed circular in section, steel stress being limited to 8,000 pounds per square inch and base of tower separated from sides to cut out the bending moment reinforcement required for bottom restraint.

The large 168,000 gallons wash water tank was rectangular in shape 90-ft. by 30-ft. by 10-ft. and the sides were designed as a beam spanning the distance between floor and an 18½-in. by 10-ft. horizontal beam which was 7-ft. up and was tied across the tank at 18-ft. centers.

For work above ground the soft native brick is used with a 1 cement, 4 lime and 12 sand mortar except under bearings, such as crane-pillars, etc. where a pressed brick of standard size is used in 3 to 1 cement mortar.

All windows in new work have steel frames, roofs are reinforced concrete where possible, elsewhere in 18-gauge corrugated sheeting laid on 1-in. tongued and grooved boarding on wooden purlins carried by steel trusses.

Pumping Machinery

Shanghai's water is an entirely pumped supply, and as giving an idea of the demand on pumps Table 1 below gives the monthly consumption and daily average for the years 1930 and 1929. Maximum daily demand usually occurs in August and was 53,496,807 and 50,796,404 gallons for the years considered.

TABLE 1.—MONTHLY CONSUMPTION.

Month	*1930* Total Monthly gallons	*1930* Daily Average gallons	*1929* Total Monthly gallons	*1929* Daily Average gallons
January ..	1,061,158,580	34,230,922	950,198,978	30,651,580
February ..	887,920,778	31,711,456	860,455,967	30,730,570
March ..	1,055,072,907	34,034,610	966,547,040	31,178,936
April ..	1,046,525,215	34,884,174	979,797,266	32,659,908
May ..	1,167,115,376	37,648,883	1,063,467,570	34,305,405
June ..	1,267,086,853	42,236,228	1,144,506,265	38,150,209
July ..	1,483,967,204	47,869,910	1,326;979,333	42,805,785
August ..	1,530,683,681	49,376,893	1,395,021,857	45,000,705
September ..	1,335,600,177	44,520,005	1,210,744,431	40,358,148
October ..	1,211,043,095	39,065,906	1,149,616,529	37,084,404
November ..	1,138,741,805	37,958,060	1,060,046,008	35,334,867
December ..	1,135,044,771	36,614,347	1,040,343,233	33,559,459

In common with all waterworks undertakings the Company has to deal with a very variable daily load. Thus the ratio of our average to our maximum hourly d mand is approximately 1.7, but engine capacity must be capable of meeting the maximum demand, and mains must be of similar capacity. A further handicap is that maximum hour increases at a greater rate than average day with consequent more rapid decrease in the load factors of older units, the natural policy being to run the newer and more economical units at high load factor.

At night for a period of about six hours demand on the mains falls to less than half the maximum capacity, and during this period water is transferred to reservoirs in the Western District (6.5 miles distant) to the extent of about two million gallons a day. Motor driven centrifugal booster pumps of a capacity of 780,000 gallons an hour are installed here and maximum demand at the Pumping Station is thus reduced to the extent of 550,000 gallons an hour, one 230,000 gallon pump being in reserve. There is also reservoir capacity at the Pumping Station to the amount of two million gallons, but the effect of this on pump demand is neglected, it being considered as reserve.

TYPE OF DRIVE.—As regards main pump extensions since 1925, prior to 1929 it was our practice to use plunger pumps and steam drive which was found to be economical at high load factors, peak load being taken by the older and more highly depreciated units. In 1929 the rise in operating costs and the onset of the fall in exchange resulted in the adoption of Diesel drive and centrifugal pumps on account of absence of standby charges, lower operating costs and much decreased capital cost. Further fall in exchange compelled the adoption of the electric drive on account of still lower capital cost.* The increasingly important factor of obsolescence, in view of possible future improvements in design, was also not without its weight in the adoption of this policy.

Table 2 gives all the necessary details relating to main pumps, and with regard to operation it should be stated that in 1930 we pumped 14,319,960,442 gallons at an average head of 130 feet at a coal† consumption of 1,921 lbs. per million gallons.

TABLE 2.—DESCRIPTION OF MAIN PUMPING ENGINES.

Main Pump No.	*Date Installed*	*Load Factor 1930 %*	*Steam per W.H.P. per hour lbs.*	*W.H.P.*	*Capacity gallons per hour*	*Average day Water Pumped 1930 24th April M.G.*
STATION No. 1						
3	1907 (rebuilt)	9.01	19.30	167.2	260,000	2.236
4	1903	0.19	20.80	161.4	268,000	—
5	1911	13.64	18.40	224.0	316,000	3.404
10	1927	46.31	14.70	304.5	400,000	7.765
Total						13.405
STATION No. 2						
6	1919	59.09	14.90	252.0	384,000	5.449
7	1921	47.23	16.19	213.0	295,000	4.389
8	1921	1.17	26.80	295.0	368,000	1.066
‡9	1926	53.16	14.70	442.9	600,000	—
Total						10.904
STATION No. 3						
11	1928	77.26	10.50	560.0	600,000	14.878
‡12	1930	15.69	2 Cycle Diesel	560.0	600,000	—
‡13	1930	82.55	Electric	650.0	660,000	—
Total						14.878
Grand Total						39.187

Average load factor 41.71%.

All these pumps, except Nos. 12 and 13, are of the steam driven plunger type. These steam units are all of the compound type with the exception of Nos. 9 and 11, which are triple expansion, the first being a horizontal double acting pump, and the last a vertical single acting set.

Photographs 12 and 13 show the three latest units for steam, Diesel and electric drive.

As regards Primary (River to Settling Tanks) and Secondary (Settling Tanks to Filters) Pumps, Table 3 gives the necessary details with regard to these, the pumps being all of the centrifugal type.

TABLE 3.—DESCRIPTION OF PRIMARY AND SECONDARY PUMPS CENTRIFUGAL TYPE.

	Working Heads	*R.P.M.*	*Output G.P.H.*	*B.H.P.*	*Drive*	*Date Installed*
PRIMARY PUMPS						
No. 14	30′	290	1,250,000	300	Electric	1919
15	30′	290	1,250,000	300	,,	1919
17	19′	260	1,000,000	190	Diesel	1926
20	19′	250	500,000	100	,,	1930
21	19′	250	500,000	100	,,	1930
22	19′	428	1,000,000	175	Electric	1931

* Power is purchased by the Company at an average cost per kw. hour, 65 per cent load factor, of Tls. 0.01½ (G.$0.006 or £0.0.0¼). Maximum demand charge Tls. 2.60 (G.$1.08 or £0.4.5) per kw. Power factor correction made.

† Calorific value of coal 11,600 B.T.U.'s per lb.

‡No. 9 engine under repair. Nos. 12 and 13 were only erected in June.

	Working Heads	*R.P.M.*	*Output G.P.H.*	*B H.P.*	*Drive*	*Date Installed*
SECONDARY PUMPS						
No. 6	32′	220	200,000	90	Steam	1902
7	32′	225	400,000	90	,,	1906
9	33′	170	200,000	85	Gas	1911
10	33′	160	200,000	85	,,	1911
12	30′	170	450,000	120	,,	1919
13	30′	160	450,000	120	Electric	1919
16	30′	175	450,000	120	,,	1923
18	26′	260	1,000,000	190	Diesel	1927
19	26′	325	1,000,000	180	,,	1929
23	33′	480	450,000	120	Electric	1931
24	33′	480	450,000	120	,,	1931

It will be observed that there are four types of drive. Policy as regards new orders has crystallized into the adoption of half electric and hall Diesel for power purposes, as no waterworks could ever be dependent on one source of power only.

The type of Diesel engine adopted was, in the first place, the four cycle air injection but, though our experience with these engines has been entirely satisfactory, lower capital costs have led to the experimental adoption of the solid injection two cycle engine in our latest secondary unit.

The later electirc motors have been of the auto-synchronous type owing to their capacity for power factor correction.

The suction gas engine was adopted at a time when anthracite was cheap and easily obtainable, but civil war and difficulties of operation in times of trouble have led to the choice of an alternative electric drive for two of these pumps and the placing of the balance permanently in reserve.

The two remaining steam units are only run occasionally.

Photographs 14 and 15 show the two types of Diesel drive.

MEASUREMENT OF PUMP OUTPUT.—In the case of centrifugal low lift pumps this is done by Venturi meters of local design, pitometers and imported Venturi meters for the main centrifugal pumps. An allowance of 2 per cent is made for pump slip.

BOILERS.—Previous to 1927 these were all of the Lancashire type, three being for pressure of 100 pounds and five for 150 pounds. The low pressure boilers have been fitted with improved grates and the 150 pound boilers have automatic stokers of the underfeed type and forced draught. These stokers are not entirely satisfactory, the evaporation obtained being very little more than for the three natural draught boilers. As a consequence we are now experimenting with a Hodgkinson's Coking Stoker working with natural draught, and hope to realize better results.

Steaming capacity of these boilers is 7,000 pounds per hour.

In 1927 we adopted the Babcock and Wilcox water tube boiler to supply power to our last steam unit, No. 11. Pressures are 250 pounds and superheat 190°. Two boilers were installed, one of 13,000 pounds capacity capable of dealing with two engines similar to No. 11 and one of 8,000 pounds capacity. In order to utilize the excess boiler power thus provided, and to work these boilers to full capacity, a by pass steam main with desuperheater has been installed to serve the engines normally dealt with by the 150 pound boilers. This will eventually reduce steam demand on these rather inefficient units to one boiler which, as stated above, is being fitted with a more efficient stoker.

The average evaporation from our boilers was in 1930:—

Pressure	*Superheat*	*Average Actual Evaporation*	*Feed Temperature*	*Economizer*	*Boiler Efficiency*
100 lbs.	100°	5.32	219° F.	83.5° F.	45.6%
150 ,,	100°	5.56	277° F.	125° F.	45.2%
250 ,,	136°	6.72	186° F.	114° F.	60.5%

Co_2 recorders and flue gas temperature recorders are fitted to all boiler houses and indicate good working results. Scaling troubles have only become serious with the high-powered boilers, and we are trying a boiler compound to rectify this.

Our average results from boiler trials indicate no bad performance.

COSTS.—Pumping costs per million gallons in the three stages of pumping are as below for the year 1930:—

TABLE 4.

	Pumpage gallons	*Cost per Million* £	*G.$*	*Tls.*	*Heads*
Primary	14,599,525,625	0.4.10¾	1.20	2.89	19 ft.
Secondary	12,967,298,500	0.5. 3¾	1.29	3.13	26 ft.
Main	14,319,960,442	1.4. 7¼	6.00	14.49	130 ft.

BORINGS.—Sub-artesian water of a sterile nature is available in the Shanghai Area and, though operating expenses are high, capital expenditure is small if the well is in a good strata. The Company has made two experiments in deep well borings of 6-in. and 8-in. diameter, using compressed air for pumping purposes. The first draws water from 750 feet, and the second from 380 feet the amount of screening in the two cases being 30 and 60 feet respectively. The water produced has been excellent in quality, but the output tends to decrease rapidly as far as our experience goes and, owing to the necessity of fine screening, the well output is not high. The design of a suitable screen to exclude fine sand is the local problem as regards borings, and the Company is experimenting in this connection. It may be mentioned that a further 12-in. boring had to be abandoned owing to failure of the screen by cutting of the wire mesh by fine sand.

CAPITAL EXPENDITURE.—As regards capital expenditure in the interval 1926-1930, some three million taels (£254,687 or G.$1,244,813) for a rise in maximum hourly demand of approximately one million gallons were expended, implying an annual capital expenditure of Tls. 600,000 (£50,937 or G.$248,963) to keep pace with increase in water demand.

DISTRIBUTION.—The mileage of mains at the end of 1930 was 171.01.

The main laying program for each year is fixed by probable maximum demand checked by pitometer surveys made every two years. As regards pipes, all larger mains are now in steel, unlined but protected by wrapping, a minimum cover of 3-ft. being provided everywhere. In common with other waterworks undertakings increased vibration due to heavy motor traffic is having its usual effects. Thus leaks per mile of main increased from 3.20 in 1929 to 4.29 in 1930.

Owing to the abnormal increase in per capita consumption, the question of general metering is under consideration, but there are serious domestic problems to be faced in its adoption. At present all industrial supply is metered, and local conditions demand a wet dial meter wherever possible. The types in use are semi-positive to 1½-in., inferential up to 3-in. and Helix type over this with dry dial.

Finally, it should be said that extensions have gone hand in hand with improvements in the working conditions of the Company's employees, of whom there are about 900. Men necessary for the operation of the plant work an 8-hour shift, and casual employees a 9-hour day. Careful statistics are kept of the cost of living and increased pay is granted on this score alone apart from rises due to merited promotion. Quarters are provided for employees at rents far below those prevailing locally, and the education of children of employees is given free, as well as suitable facilities for recreation.

Photograph No. 16 shows the type of staff quarters provided for Chinese.

All the works referred to have been carried out to the design, and under the direction, of Mr. C. D. Pearson, M.INST.C.E., M.I. MECH.E., the Engineer-in-Chief and Manager of the Shanghai Waterworks Co. Ltd., to whom the author is indebted for permission to make use of the above information.

N. B.—Rates of exchange taken throughout are the averages for 1930, *i.e.* Tls. 2.41=G.$1.00, Tls. 1.00=£0.1.8⅜

Machine Works for China

Approval for the establishment of a Central Machine Works to hasten the industrialization of China is sought in a petition of the Ministry of Industry to the Executive Yuan. The project will be capitalized at $3,100,000. The Ministry proposes that $2,500,000 of this amount be appropriated from the British Boxer Indenmity Refund and the balance by a loan from the Manufacturers' Bank of China.

It is pointed out that the plan was approved at a meeting of the Board of Trustees for the British Boxer Indemnity Refund held on May 2, 1931. Negotiations for a loan from the Manufacturers' Bank of China are also being made. The loan will be secured on the machinery and equipment purchased from Great Britain for the factory.

The site of the projected plant will be at Sanchiaho in Nanking and will cover an area of 1,000 mow.—*Kuo Min.*

The Proposed Electricity Supply System for the Canton Delta

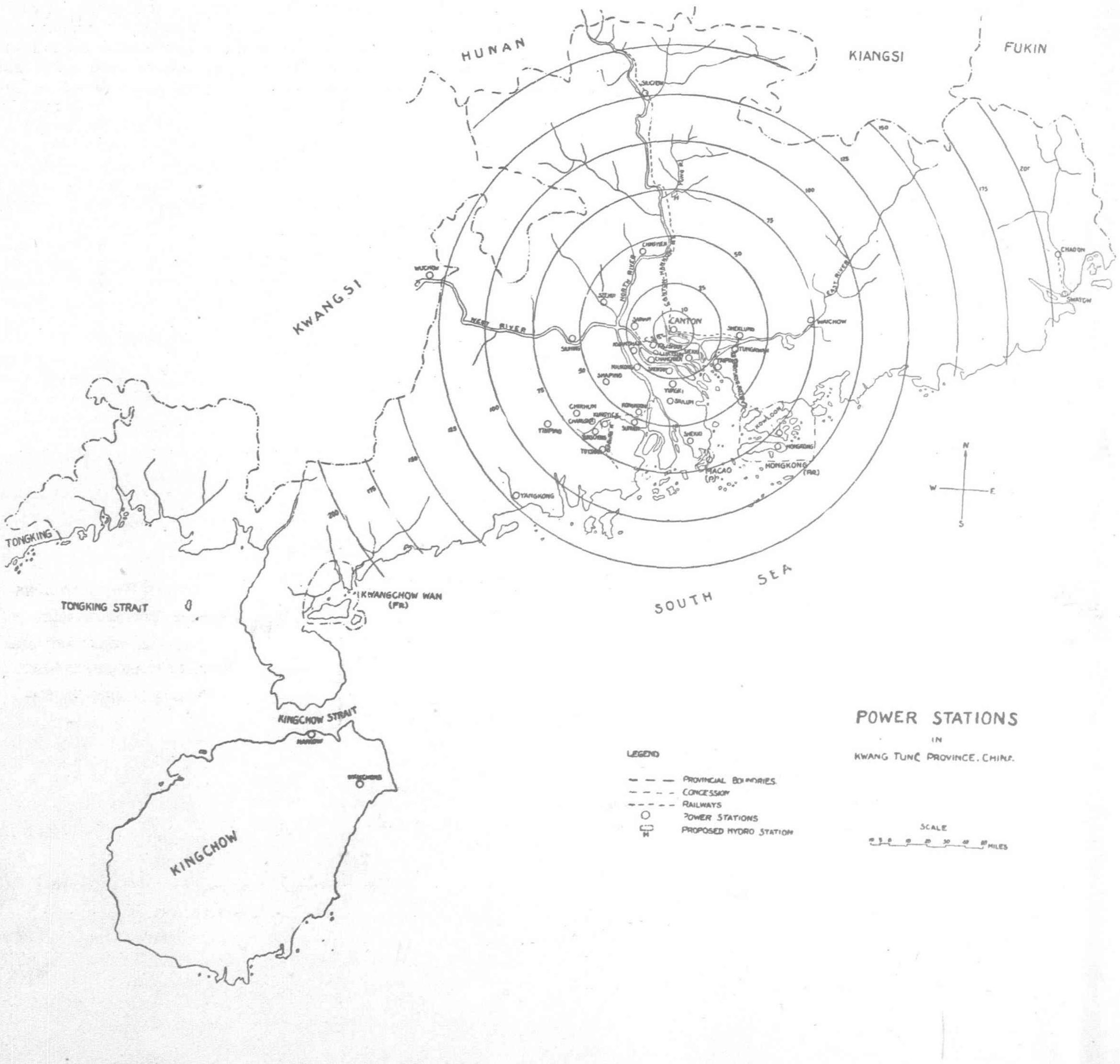
By Y. M. CHU, Member A.I.E.E., Engineer, Kwangtung Electric Supply Co., Ltd., Canton, China

(The following article is supplementary to a preceding article published in the May number of the "Far Eastern Review" on the subject "Electricity Supply Scheme for the Province of Kwangtung, Portuguese Colony of Macao and the British Crown Colony of Hongkong," by Mr. W. F. Gilman.)

Canton Delta is at the meeting point of East, North and West Rivers in Kwangtung. It is situated on the coast centrally located and is the richest section of the province. This Delta has an area of about 3,000 square miles and a population of eight millions. The whole area is inter-connected by numerous water-ways providing ample facilities for transportation. The principal industrial and commercial cities are Canton, Fatshan, Kongmoon, Chan Chuen, Siu Lam and Tai Leung (Shun Tak), all of which can be reached by steamers and some by rail in a few hours from Hongkong and Kowloon.

At present there are 34 power stations in Kwangtung exclusive of: (*a*) one in Hongkong, (*b*) one in Kowloon and (*c*) one in Macao (see map: "Power Stations in Kwangtung Province"). These stations have a combined installed capacity of 31,000 kw. (Kilowatt) or 6 per cent of the total installed capacity in China (528,000 kw. in Government and utility companies while 308,000 kw. in industrial plants). The total investment in these stations is 15,700,000 dollars, local currency, or 3,300,000 dollars, gold, at the present exchange rate. This is 6 per cent of the total investment (221,027,000 dollars, Mex. or 55,257,000 dollars, gold) for the electric light and power industry in China. These stations are grouped in zones with Canton as the hub (see sketch: "The Proposed Electricity Supply System for the Canton Delta"). From this sketch it will be observed that there are eight stations within the 25-mile zone; their present combined installed capacity being 21,750 kw. or 70 per cent of the total capacity for the whole province. Within the 50-mile zone there are 18 stations with a combined capacity of 25,330 kw. or 82 per cent of the total. In the 75-mile zone there are 27 stations with a combined capacity of 28,110 kw. or 91 per cent of the total. All of these are on the south-western side of Canton.

Most of these stations are heavily over-loaded with a resultant



unsatisfactory service. The installed generating capacity should be increased from 50 to 300 per cent immediately. The total requirement for this 75-mile zone by the end of 1940 is estimated at 80,000 kw. It is probable that this estimated requirement is too conservative as the future industrial and commercial developments are very promising.

Nearly all of these stations generate at 60 cycle, 2,200 volt, three-phase. The distribution systems are : (*a*) three-wire 220-110 volt, or (*b*) two-wire, either 220 or 110 volt. The equipments mostly used are of either Continental or American manufacture. A wide variety of prime movers are at present in operation, the most favored being : (*a*) Diesel oil engines, (*b*) coal producer gas engines, (*c*) steam turbines, (*d*) steam engines and (*e*) various combination of these.

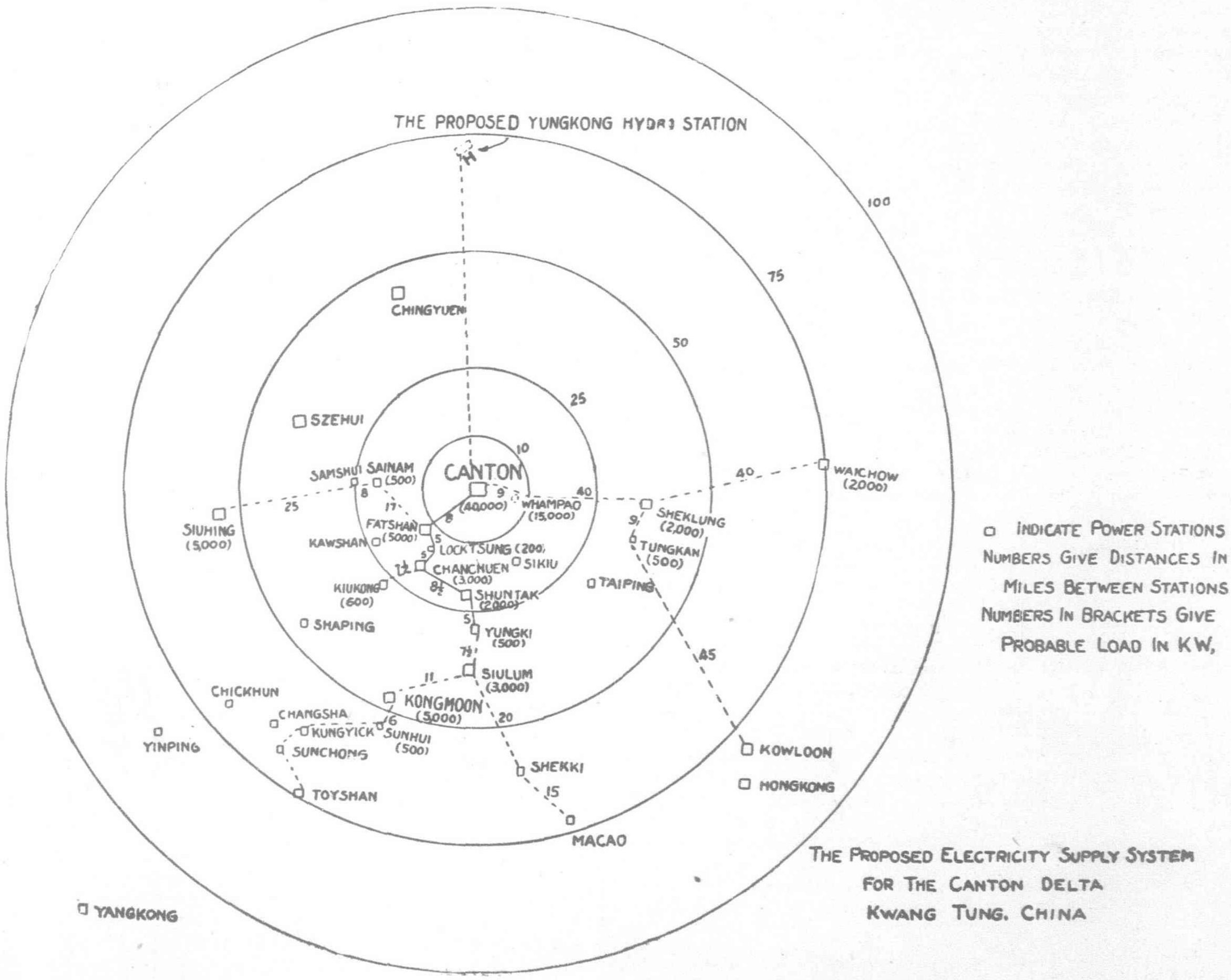
A large number of these stations were erected between 1910 and 1920. At that time it was very difficult to obtain a franchise due to keen competition between gentries and business men each faction endeavoring to obtain control over specified areas. This resulted in excessive inauguration cost regardless of the contending parties. Some stations were incorrectly located. Equipments were purchased without due consideration to either : (*a*) suitable type, (*b*) extra capacity for future growth, (*c*) cost of transportation and erection, (*d*) economy of operation, (*f*) simplicity and convenience in running and repairing, all of which resulted in excessively high operating and maintenance cost.

The distribution systems do not have sufficient copper. Material and workmanship are poor resulting in heavy line losses. There is also too much current theft and meter tampering. In most places the percentage of unaccounted-for kwh is high. 65 per cent is not uncommon. The present rates range from 20 to 45 cents (3.85 to 8.65 cents, gold) per kwh ; or $1.50 to 1.80 (29.0 to 34.6 cents, gold) per 25-watt lamp per month. Combining these unfavorable conditions with the ever rising cost of labor, fuel and material it is readily observed that the majority of these stations can hardly survive. The net result is a noticeable decline in the service rendered. This is due on the one hand to a gradual increase in the load and on the other to the inability of the management to obtain necessary funds for improvements and extensions.

With a view to assisting these operating stations in Kwangtung Province, especially those in the Canton Delta, to give the people satisfactory, reliable and economical service and at the same time promote the development and modernization of these cities, this solution to the electricity supply problem is proposed.

The proposal is to build a new steam station in or near Canton City with an initial generating capacity of 50,000 kw. and to erect a high tension transmission line from Canton through Fatshan, Lock Tsung, Chan Chuen to Tai Leung (Shun Tak) (see solid line in sketch : " Proposed Electricity Supply System for the Canton Delta "). When the demand for this power is warranted and the return on this investment guaranteed, this line can be extended to Yung Ki, Siu Lam, Kongmoon, Sun Hui and further (see dotted line in the sketch). Other lines (also dotted in the sketch) can be erected linking up all of the existing stations within the 75-miles zone. Subsequently, for further extensions, replace these linked up power plants with substations and transfer their equipment to other power plants in the province but beyond the 75-mile zone. The transferred equipment is old, very inefficient, and in some cases obsolete. It will be discarded if found advisable.

To meet the ever rising cost of fuel and labor it is proposed to equip this new steam station with modern machinery of the highest efficiency and to include such labor saving devices as to make the operation of the station practically automatic. The estimated cost



THE PROPOSED ELECTRICITY SUPPLY SYSTEM
FOR THE CANTON DELTA
KWANG TUNG, CHINA

of this station with initial equipment for 50,000 kw. is 6,250,000 dollars, gold.

The transmission line represented by the solid line in the sketch will be of 25,000 kva. capacity. It will be designed with a factor of safety ample to meet the severe weather conditions in this locality. The estimated cost of this line is 470,000 dollars, gold. The total installed cost of four substations for this line is about 280,000 dollars, gold. From the foregoing it is seen that the total cost for the electricity supply system for the Canton Delta is 7,000,000 dollars, gold.

There are many suitable locations in this province where hydro-electric plants may be installed. The most noted one is the proposed Yung River project. Some 15 years ago it was estimated that a certain site would develop 20,000 kw. Last year the author was requested to join the Government party to make an inspection trip along that river and investigate it. After careful study and consideration he picked out a site about 10 miles below the one formerly selected. He estimated the power to be 10,000 kw. minimum, during dry seasons, and 60,000 kw. maximum, during rainy seasons. The cost of developing this power in the new site and transmitting it to Canton City is about 15,000,000 dollars, gold.

The present installed capacity of the Canton station is: (*a*) 16,000 kw. in steam turbines, (*b*) 700 kw. Diesels in operation and (*c*) 2,000 kw. Diesels in the course of erection making the total of 18,700 kw. As an alternative it has been suggested that: (1) this station will be enlarged by the addition of a 15,000 kw. steam turbine unit with necessary equipment at the cost of about 1,500,000 dollars, gold, and, (2) the Yung River hydro-electric station will be built with an initial capacity of 20,000 kw. It is then proposed to operate the hydro-electric plant as a base load station and reserve the Canton plant for a peak load and standby station; as at the present the day load for the Canton Delta is about 5,000 kw. and the peak load about 25,000 kw. The total cost for this alternative is approximately 17,200,000 dollars, gold. Due to financial difficulties and unfavorable local conditions it is probable that this alternative may not be considered for the time being.

The people in Kwangtung in general and those in the Canton Delta in particular will be greatly benefited by reliable and economical power supplied in the following ways: (1) building a modern and efficient steam station in Canton, (2) linking up the principal cities in the Canton Delta by a power transmission system, (3) replacing the existing small and inefficient power plants with substations and (4) transferring the equipment from these plants to other plants in the province for extensions. As a result the cities in this Delta may be developed and modernized rapidly.

The method of carrying out the work outlined above is to induce all the electric light and power companies in the province to form an associated company or to organize a holding company to buy up or gradually absorb these small companies. The author believes that this can be easily accomplished by the newly-formed *Electric Industry Association of Kwangtung Province*, since most of these companies are members of that association and at the persent are struggling hard for existence. Undoubtedly they will welcome a helping hand and readily consider any proposition that will safeguard their investment and assure them a fair return.

The advantages of having an associated company or a holding company to take care of the electricity supply system for the Canton Delta or the whole province are as follows:—

(1) Equipment, material and fuel can be purchased in large quantities at lower prices by one big organization.
(2) Equipment and practice can be standardized for the entire province.
(3) Technical and management experts of the highest quality can be employed.
(4) Men trained by one big organization are better qualified to more efficiently supervise the operation and maintenance of the equipment.
(5) Extensions and improvements, when required, can be carried out more quickly and economically by specially trained men.
(6) Many difficult utility problems now before the small companies may be avoided or more easily solved by one big company.

To raise 10,000,000 dollars, gold, ((*a*) 7,000,000 for a new station, transmission line and substations as outlined above, and (*b*) 3,000,000 for materials for line extensions and improvements) for the electricity supply system for the Canton Delta is a difficult undertaking under the present social, economical and political conditions and with the present utility laws recently proclaimed by the Central Government. However, the author believes that the Central Government will soon become stable and conditions gradually improve. He feels sure that both the provincial and Central Governments will give the electric light and power industry necessary protection such as fair regulation, severe punishment for current theft and equitable rates on which the industry can get a reasonable return on its investment plus a certain percent of profit which will enable the industry to obtain money for extensions and improvements when needed. It is also hoped that the Central Government will revise the utility laws so that foreign financiers will be more readily attracted. This will result in the utilization of foreign funds for the development of this industry on which the national health, development, progress and the happiness of the people depend.

Notable Projects in Osaka

American Consul E. R. Dickover, Kobe, reports that work was started in 1930 on the new Osaka station of the Imperial Government Railways. This station is planned to cost about $49,000,000 and will be the largest in the Far East. The first stage of the project was begun in 1930, and by the close of the year the concrete work of three of the five overhead lines had been completed at a cost of $563,000. These overhead lines will be connected by a large concourse, 130 by 300 feet, work on which was begun this year. The elevation of these lines is expected to be completed by the end of 1933, when the elevated system will be put into operation. The main building of the station will be erected later and completed by the end of 1935. Japanese designs, materials, and labor are being used throughout.

Rebuilding of Keep of Osaka Castle

A new departure in construction practices appeared in Osaka in 1930 in the rebuilding, in ancient Japanese style, of the main keep of the Osaka Castle. This castle, first built in feudal times, has been destroyed and rebuilt on various occasions, the last being at the time of the wars connected with the restoration of the Imperial power in 1867 and 1868. The walls, moats, gates and watch towers of the castle remain, but the main keep has not been rebuilt; in 1930 its rebuilding on the ancient foundations was started. The exact designs of the original castle are being followed as far as possible, the only modern touch being the material used, which is reinforced concrete. The castle is to be completed in 1931.

The building, in pure Japanese style, of structures of reinforced concrete has been tried before, but only in smaller buildings such as temples. The construction of a large, three-story or four-story structure of reinforced concrete, in the ancient Japanese style, is believed never to have been attempted.

Osaka Central Wholesale Market

The new Osaka Central Wholesale Market, which is a municipal undertaking, was nearly completed in 1930. This public market, said to be the largest in the world, covers an area of 29 acres and cost $8,900,000. The buildings, of reinforced concrete, cover an area of 11 acres and consist of wholesale stalls, receiving and shipping sheds, cold-storage warehouses, ordinary warehouses, fruit ripening plants, and an administration and office building.

Most of the buildings are of one story, but the administration and office building is of five stories, with the exterior finished in white tiles. The market will be connected with the Imperial Government Railways, and as the site is on the Ajikawa (Aji River), water transportation facilities are available for vessels up to 1,000 tons. The entire space not covered by buildings has been paved and provided with sewers, water mains and other necessary facilities. This market is to take the place of three markets formerly used in Osaka.

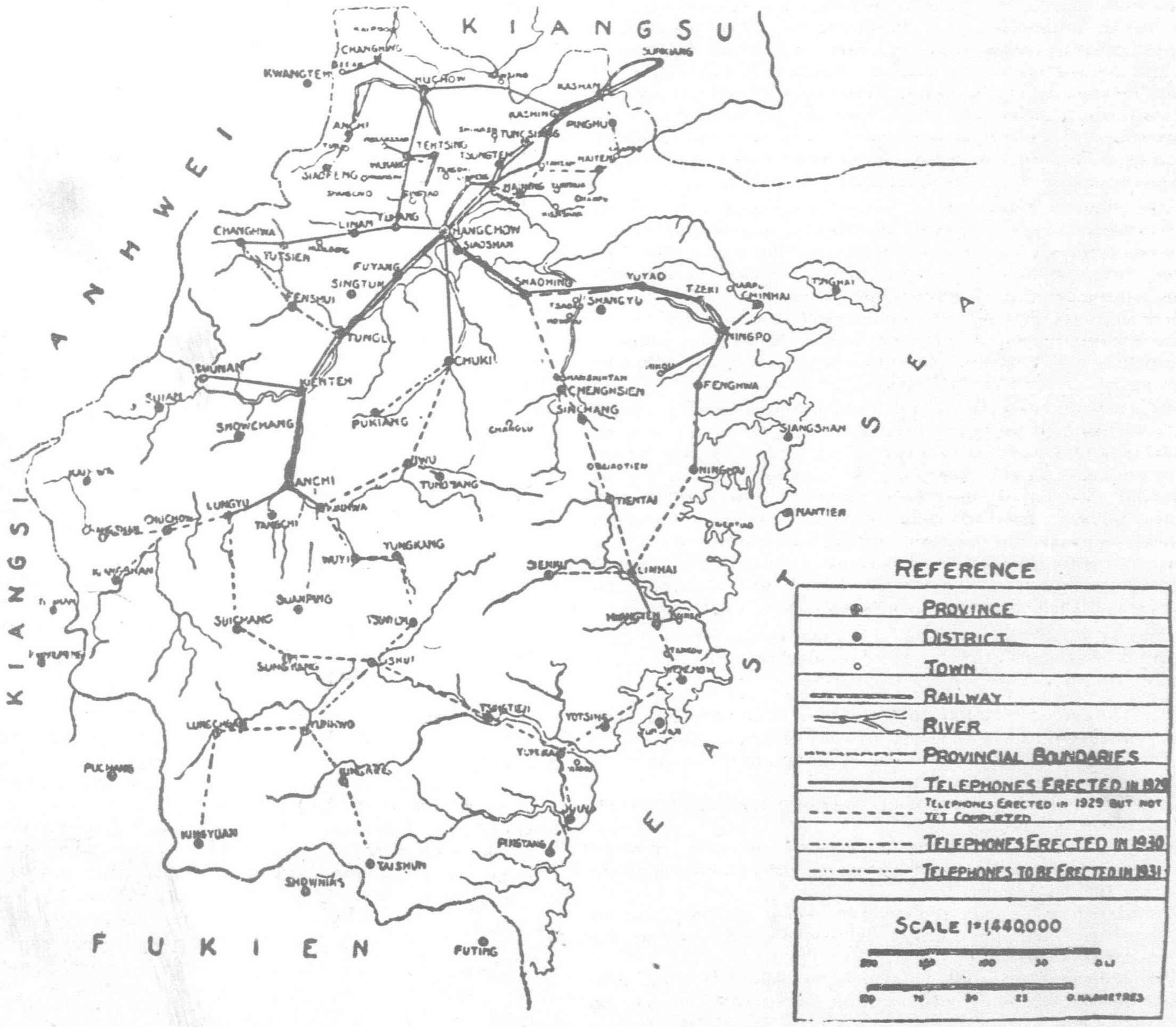
Telephones in Chekiang

TELEPHONE service made its first appearance in Hangchow toward the end of Tsing dynasty, to be exact, in the year 1905—when the Merchants' Railway Company installed a telephone establishment at Hangchow for the purpose of making direct communications between merchants and officials of the city and between merchants themselves. The telephone company at that time operated on a very limited scale and it was reorganized in 1909 when city officials took over the management. Government shares were then only $50,000. Very few subscribers were found among the merchants and residents and the system consisted of only single wires. Later on other merchants obtained permission from the authorities to share in the enterprise by raising another $50,000 as new capital.

The manager of the telephone company after reorganization was Mr. Wang Zung-pai. In 1911 the company was converted into a private undertaking with Mr. Kao Tse-pah as manager and three years later the company founded its new premises at Shan Hwa Kwang Lane with double wire system. The subscribers at that time numbered about 500. Later on, under the careful management of Messrs. Hsu Sing-ju, Yu Tan-ping and Wang Chu-tsa, the telephone business in Hangchow became very prosperous, resulting in general expansion of the company. Consequently four substations—namely East, West, South and North—were established in order to meet the pressing demand. Up to 1925 there were over 1,600 subscribers, showing an increase of 1,100 subscribers as compared with the year 1914. A business slump set in in 1927. This was partly attributed to the mismanagement of the company and partly to the poor service on the part of employees.

At the end of 1929 the company was reorganized and converted again into a government enterprise with the hope to recover what has been lost during past few years. Following the reorganization period, the Provincial Telephone Administration Bureau was formed to take over control of Hangchow Telephone Administration. This provincial bureau has two functions; one is to stimulate interest among subscribers not only in Hangchow, but also in other large cities, and the other is to encourage the building of a long-distance telephone system throughout the province. Accordingly some local telephone administration bureaux were established in business centers particularly in Kinhwa, Lanchi, Kienteh and Haimen.

In reorganizing the Hangchow local Telephone Administration, it was found that its total liability amounted to well over $240,000, The Provincial Administration Bureau right after its formation



Map showing the Route of the Long-distance Telephone Wires in Chekiang Province

took measures to liquidate the indebtedness of its predecessor. It was divided into instalments and to be paid up within four years starting from 1930. For the first two years payments are made quarterly, while for the next two years the payments are made semi-annually. Taking all in all there shall be a total of 14 instalments.

The business of the Hangchow Telephone Administration after its reorganization registered a successful progress. The average monthly receipts for a period of seven months (from December, 1929 to June, 1930) amounted to about $13,000. The details are given below:

Items	*Total Amount in dollars*	*Percentage to its G: and total*
RECEIPTS		
From subscribers	11,943.86	89.36
From Reinstallation, etc.	1,422.14	10.64
Grand total	13,366.00	100.00
DISBURSEMENTS		
Salaries of employees	5,202.05	38.92
Rewards and Pensions	498.55	3.73
Maintenance	1,712.18	12.81
Materials for installation	944.98	7.07
Miscellaneous expenses	73.51	.55
Interest on debts	2,943.10	22.02
Profits	1,991.54	14.90
Grand total	13,366.00	100.00

From the above it seems that The Hangchow Telephone Administration under the Provincial control has proved itself not only able to pay off its debts by instalment basis, but also to reap a handsome profit each month. The present number of subscribers amounts to well over 2,270, showing an increase of 600 as compared with 1925. The present policy of the Local Administration is to raise interest among subscribers whenever possible. On every Tuesday, Thursday and Saturday the Local Administration is ready to receive guests for general inspection. It is the desire of the Administration to receive criticism at any time.

The future plan of the Administration is to install automatic telephones throughout the province. Arrangements have been made with the China Electric Co. to replace an old equipment to the new one which, when completely installed will be able to accommodate about 3,000 subscribers. The cost of the equipment runs to about G$229,000. It is understood that at the time of making the contract with the company 5 per cent of the total cost should be paid up and 5 per cent to be paid at the time of arrival of the equipment at Shanghai from America. When completely installed and ready for use another 5 per cent is to be paid as stated in the contract. The remaining 85 per cent will be paid off in 16 instalments during a period of eight years, with interest at the rate of 6 per cent per annum.

In remolding the existing system into an automatic exchange engineering activities are required, including the building of 63 manholes and 6,000 porcelain duct plates of which 1,600 are made with two holes, 2,200 with four holes and 2,200 with six holes. In addition ducts of considerable length (about 15,000-ft. altogether) are constructed. The new premises for the Company is at Weihing Road. The amount required for building the new accommodation as estimated runs about $77,000 and the building will not open for use until April of the following year. The laying of ducts and wire installations are no easy matter. The whole project requires several months for its completion and it is calculated that not until August of the following year will all preliminaries be accomplished.

The new construction is a three-storied building including one engine room, one battery room, one surveying and the other an operation room. The automatic machines are ordered from Belgium. In the coming spring the Provincial Authority will appoint Mr. Chow Yu-kun, the engineer-in-chief of the Provincial Telephone Administration Bureau, to be the special delegate to Belgium for the purpose of investigating the telephone system in that country as well as in other European countries. The delegate will not return to China until October. It is the hope of the Administration that upon his return a general scheme of improvement will be suggested.

Long-distance Telephone

For past years the general extension of long-distance telephone service in Chekiang province was a part of the plan to connect the five provinces of Chekiang, Fukien, Kiangsu, Anhwei and Kiangsi in a single system as ordered by the former Tuchun Sun Chuan-fang. According to this plan, the provincial authorities worked in conjunction with the telegraph superintendents of these provinces. The first step was to establish telephone connections between places where telegraph communications were considered to be inadequate to meet the needs of the military, the official and commercial classes. Next came the important cities and towns where telegraphic communications were still lacking. Finally the general exchanges were to be established at all important points in the five provinces through which the telephone lines passed, like Hangchow, Huchow and Chuchow in Chekiang province; Foochow, Shunchang, Liencheng and Tungan in Fukien province; Shanghai, Nanking, Tsingkiangpu and Hsuchow in Kiangsu province; Anking, Pengpu and Taiping in Anhwei province and Nanchang, Kian and Kanchow in Kiangsi province.

The expenses incurred in the installation of these long-distance telephone services were to be met from surplus receipts of the telegraph administrations of the five provinces, any deficit to be made up by appropriations from the provincial government treasuries. Telegraph superintendents of these provinces were appointed concurrently to take general charge of the long-distance telephone services, and in districts where there were telegraph lines, the telegraph poles were used for hanging telephone wires instead of setting up new poles. The chiefs of local telegraph offices were charged with managing the long-distance telephone service in their respective districts. The following places were connected with long-distance telephone service during the past few years: Hangchow, Changan, Tsungteh, Shihmenwan, Tunghsiang, Kashing, Wangkiangking, Wangtien, Siashih, Sinhwang, Haiyen, Pinghu, Chapu, Kashan, Kanyao, Fengking, Sitang, Wuchen, Nanzin, Tehtsing, Shinshih, Songling, Kiukuan, Chihli, Linghu, Yuankiahwei, Tikang, Changchao, Huchow, Hungsingkiao, Changhing, Szean, Meiki and Anchi.

Since the inauguration of the Provincial Telephone Administration Bureau considerable attention has been given to the laying out of long-distance telephone service throughout the province and consequently a new arrangement of system is planned. The original proposal is to establish nine main lines but later this was increased to thirteen routes which are as follows: (1) Hangchow-Fengching line from Hangchow to Fengchin *via* Changan, Tsungteh, Tunghsiang, Kashing and Kashan; (2) The Hang-Chang line from Hangchow to Changhing *via* Yuhang, Wukang and Huhing; (3) Yu-Chang line from Yuhang to Changhwa *via* Lingan and Yutsien; (4) Hang-Ching line from Lungyu to Chingyuan *via* Sungyang, Lishui, Yunwo and Lungchuan; (5) the Hang-Tai line from Hangchow to Taishun *via* Chuki, Iwu, Kinhwa, Wuyi, Yungkang, Tsingyun, Lishui, Yunho and Kingning; (6) Hang-Ping line from Hangchow to Pingyang *via* Siaoshan, Shaohing, Chenghsien, Sinchang, Tientai, Linghai, Hwangyen, Wenling, Yotsing, Yungka and Jujan; (7) Ka-Hu line from Kashing to Huhing *via* Nanzin; (8) The Chang-Sze line from Changhing to Szean; (9) Kienyu-Shunan line; (10) the Lung-Chang line from Lungyu to Changshan; (11) the Lan-King line from Lanchi to Kinhwa; (12) Lishui-Yung line, from Lishui to Yungkang and (13) Shaohing-Linan Line. The total length of these lines is 4,548 li or about 1,500 miles.

According to recent investigation, out of thirteen main routes nine have been completed while the rest are partially constructed. Those completed are Hangchow-Changhing, Hangchow-Fengching, Hangchow-Changshan, Yuhang-Changhwa, Kashing-Hushing, Changhing-Szean, Kienyu-Shunan, Lanchi-Kinhwa and Shaohing-Linan. Besides the main routes, branch lines are also laid out, including Wukang-Mokanshan, Changan-Haining, Changan-Linping, Tsungteh-Shihwan, Nanzin-Wuchen, Nanzin-Songling, Nanzin-Tsangzeh, Huhing-Lingwo, Hwangyen-Haimen and Fengwa-Chikow. There are also a number of smaller cities and towns connected with long-distance telephone service under private operation. Those already open for use are Tehtsing, Chapu, Puyuan, Ziachiao, Hwangkiangking, Tangchi, Tachien, Chihli, Yuanhwa, Meichi, Hungsingchiao.

Telephone service with cities of Kiangsu province has been also inaugurated. Sungkiang, Shanghai, Ihing, Changchow, Kintan,

(Continued on page 491)

The Tin Industry of Yunnan

By MARSHALL D. DRAPER

No mining field perhaps has been the subject of more curiosity, speculation and uncertainty in recent years than that of Kotchiu, in the district of Mengtze, in the Province of Yunnan, China, and it is therefore of much interest to come upon the first authoritative and detailed description of this substantial tin producer through the medium of an account written by Mr. Marshall D. Draper in the American Institute of Mining & Metallurgical Engineers publication, *Mining and Metallurgy*, in the issues of April and May of this year. Mr. Draper was for some years Chief Engineer of the Kotchiu Tin Company and his connexion with the district is further revealed in the course of his article.

Access to the field is obtained through the Port of Haiphong, two to three days' sail from Hongkong. From Haiphong, the French Government has constructed a meter-gauge railroad, north through the low lying and intensely cultivated and well-watered plains of Tonkin into Yunnan. This railroad, at Lao Kai, on the border, begins its climb to the high plateau of Yunnan. The distance from Haiphong to Yunnan-fu, the capital of Yunnan, is 862 kilometers or 539 miles. The trains are run only in the daytime, stops being made each night. It requires three days to go from Hanoi to Yunnan-fu. The route is picturesque and the scenery rivals that of the American western States. At the end of the climb from the border is the plain of Mengtze at an altitude of 4,350 feet. Across this plain and through the succeeding mountain regions a branch railroad of 60 cm. (2-ft.) gauge 70 km. (44 miles) in length, has been built from the station of Pe Tse Chai to the city of Kotchiu, the center of the tin mining activities.

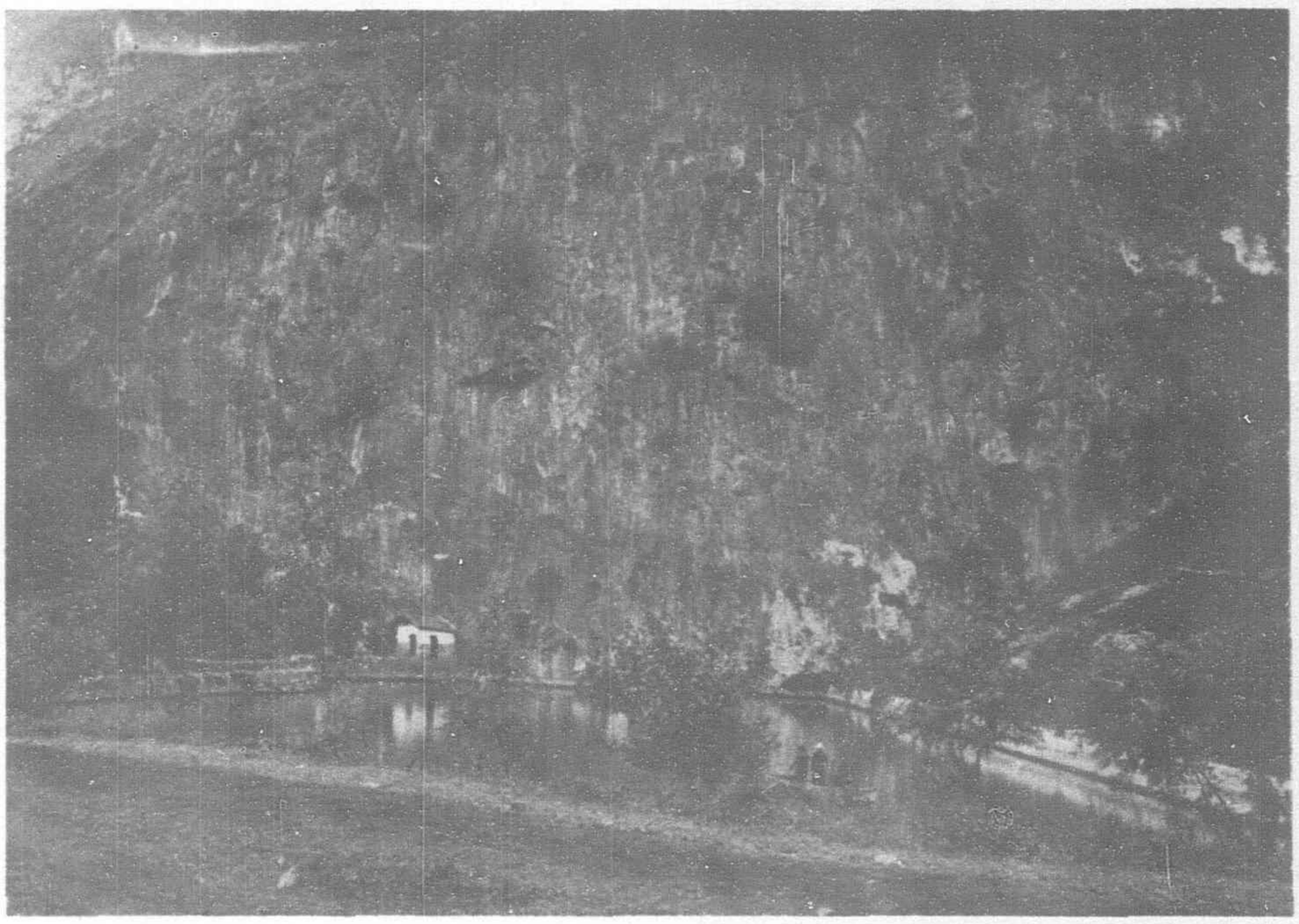
Mengtze, a small walled Chinese city, is seven miles from Pe Tse Chai. It has a population of about 15,000, including a small number of French, British and foreign residents. It has a foreign hotel, and, being a treaty port, an office of the Chinese Maritime Customs. It is also the headquarters for French officials who operate the main line of the railroad for the colonial government. The traveller, in proceeding from Haiphong, must stop overnight at the border town of Lao Kai, and again at Mengtze, so that the trip to Kotchiu occupies three days.

Kotchiu, a thriving town of some 30,000 inhabitants, is in a narrow valley at an altitude of 5,640 feet west of a range of mountains separating the Kotchiu valley from the larger and lower adjoining Mengtze plain. The tin mines are all in this range at a distance of three or seven miles from the town of Kotchiu, and at altitudes of from 8,000 to 8,500 feet.

The crude ores are all concentrated roughly at the mines and packed on mules to the town for smelting, local laws prohibiting smelting elsewhere. Virtually all of the inhabitants of the town and region are dependent on the tin industry. All told, from 50,000 to 75,000 people, depending somewhat on the price of tin, local conditions as to costs, and the prevalence of fighting or banditry are supported by these mines.

At Kotchiu there are no foreign hotels or other provisions for business with foreigners and until the last few years foreigners have not been welcome there. Mining in the Kotchiu district, according to various available records, probably commenced about 1400 A.D.

It is of interest to note that both from the Chinese records of production as well as the evidence of many large ancient workings, the province of Yunnan has been in the past very productive of gold, silver, copper, tin, lead and zinc. The tin mines, as stated, are of considerable antiquity, but they have only reached their present production of some 8,500 short tons (of 2,000 lbs.) annually within the past thirty years. Prior to that probably a few hundred tons annual production, or at most one or two thousand, satisfied the demands of China for the metal, since little or none was sold abroad. When the political conditions of China shall have become stabilized and when also the problems of transportation have been at least partly settled by the construction of roads, it is likely that some of the abandoned mining districts in Yunnan will warrant development, particularly in those cases where trouble with water was the principal cause of their abandonment.



A Reservoir near the Malaga Tin Mines showing Topography of the Country

The following figures of production for recent years (short tons) are from the records of the Chinese Maritime Customs through whose hands all tin produced passes for purposes of taxation. There being no means of egress for the tin metal other than the railroad and there being no local consumption of tin metal, the statistics should be accurate. 1923 8,745, 1924 7,683, 1925 9,844, 1926 7,253, 1927 6,802, 1928 7,630. The average for 17 years is 8,615 short tons.

The tin is exported in the form of flat slabs of about 75 lbs. weight, and carrying an average content of 96.5 per cent tin. All tin is shipped to Hongkong, where it is refined to marketable grade and where it then enters the usual trade channels designated as "Chinese tin," containing a minimum of 99 per cent tin.

The low production shown in 1926 and 1927 is due to the very disturbed political conditions in the province. There were many battles fought at various places in the province, and in the fall of 1927 two opposing forces of semi-bandit soldiers fought a pitched battle at Kotchiu, which lasted six days, and during which time much of the business section was looted and burned, several hundred people were killed and property amounting to the value of about $5,000,000 Yunnan was destroyed. The author of these notes was present at Kotchiu at the time, and spent a very uncomfortable week while the fighting was going on.

Kotchiu is in the same latitude as southern Mexico and Cuba, and like Mexico, is on an upland plateau at an altitude of 5,500 feet. Rains start in May and continue heavy for some four months, with occasional showers until February, when the dry season begins. During the rainy season water, collected in pits at the various mines is used to concentrate roughly the ore mined in the dry season. This causes a considerable variation in output from season to season. Smelting also is most active during the rainy

months, as every attempt is made to smelt the concentrate as soon as produced. The annual rainfall averages 90 inches. The region is very healthy. Malaria is practically unknown and the ordinary epidemics of infectious diseases existing elsewhere in China are at a minimum in Yunnan.

General Features

The ores at Kotchiu come from two principal areas, the southern district and the Malaga or northern district. The southern district, occupying an area of roughly four miles square and whose northern border lies five miles south of the town of Kotchiu, contains most of the producing lode mines—about 40 in number—together with about 200 open-pit workings. Most of the lode mines are working at present, but very few of the open-pit workings are now in operation and they only in the height of the rainy season. The southern district supplies about 85 per cent of the total output of Kotchiu. About 90 per cent of this is derived from underground mining and about 10 per cent from open pits.

The Chinese have always been most jealous of the presence of foreigners. Largely for this reason, examinations by the few engineers who have visited the locality have been confined heretofore to the most hurried and casual trips on horseback or sedan chair, and necessarily only the most obvious features were seen. Also, as the underground operations are almost invariably conducted in ore, the dumps that one usually associates with large mining operations are not in evidence. The vicinity of the lode mines is covered with a multitude of patios for crushing the ore, washing planillas, storage reservoirs, dams, banks and sluices, and the entrance to even the largest lode mine is often through some inconspicuous small opening set away in a corner. For these reasons the impression is general that the output of the Kotchiu mines is largely derived from the surface placers, that in common with such deposits they would soon be exhausted, and that consequently the district is of little economic importance. It is probable that the accessible and easily worked placers did account, in former years, for much of the production, but that period passed fifty to one hundred years ago. The lode mines now actually account for an increasingly larger amount of the output. At present, as stated, they supply about 90 per cent of the total tin produced. Examination of at least some of the mines has shown that development over a period of years has widely extended the limits of the orebodies underground.

The northern district is much smaller in extent and has only two producing areas of note, namely, Malaga (Ma La Ka) and Goo San. Malaga is a comparatively young mine, as the placers there were worked first some forty years ago. Some few encouraging indications found in these placer operations resulted in underground exploration which, over a period of development during the last ten years, has opened deposits of lode ore of increasingly greater importance. In the last fifteen years, since the Government-owned tin company, the Yunnan Kotchiu Tin Trading Co., acquired the mines operations have expanded so that the Tin Company, as it is locally called, has now become the largest individual producer at Kotchiu, with an annual output of about 1,000 tons. Some three miles to the east of Malaga is an isolated area known as the Goo San placers, giving occupation to abont 2,000 men. The output, all derived from ground sluicing or other placer operations, is relatively small.

Scene in a Typical Mine Pit

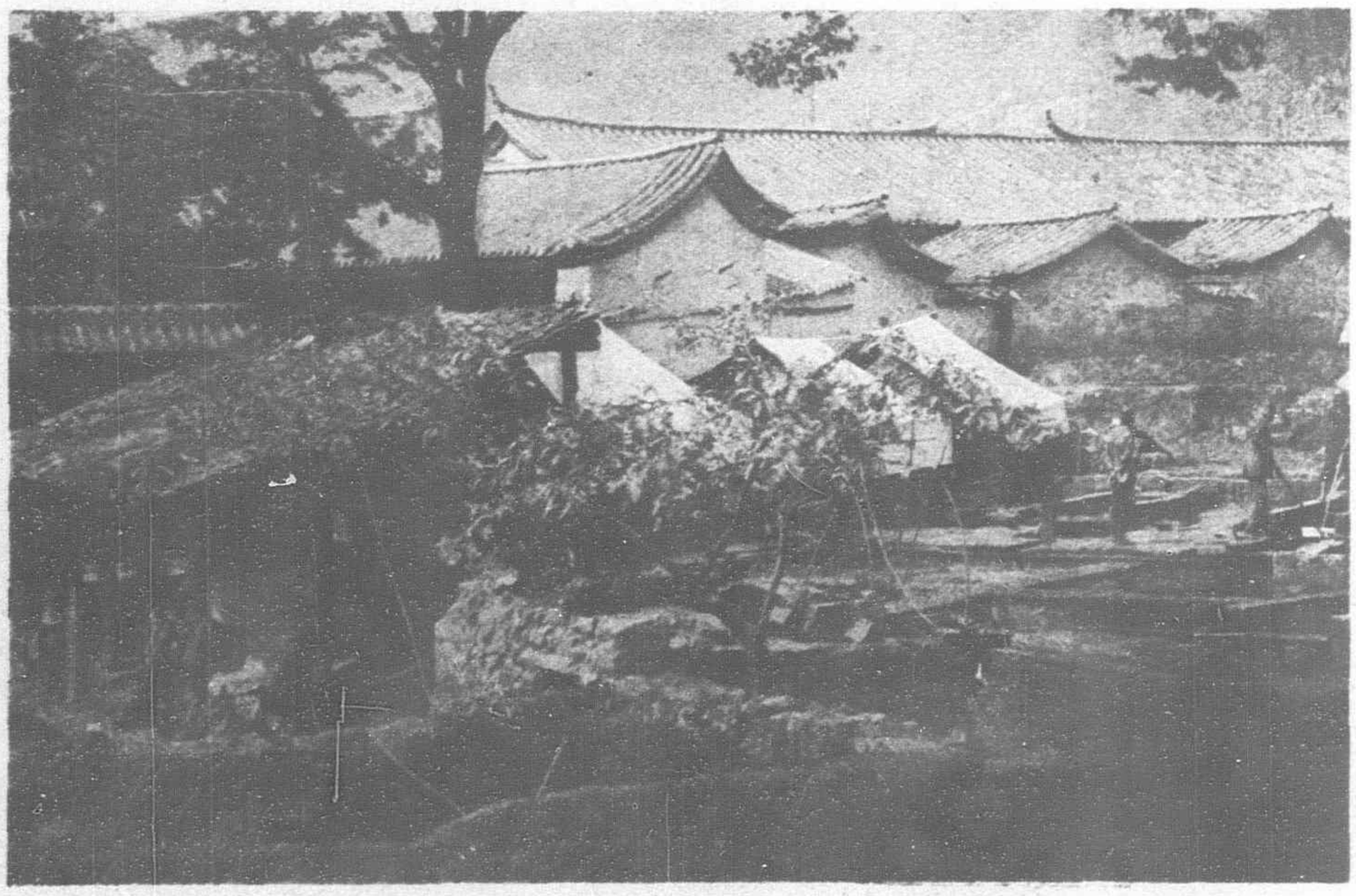
The situation of the Kotchiu district as a whole is much like that of Cripple Creek, Colo. The mines are all in the higher hills, above the town of Kotchiu, at an altitude of about 8,500 feet. Three or four small villages scattered through the district among the mines supply the wants of the native miners.

The topography of Yunnan is of the "karst" type and in the southern district in particular is marked by steep-sided and rounded sugar-loaf hills of limestone. These often enclose valleys, basins or sinks without any visible drainage. The sinks are responsible for much of the placer operations. There is much evidence leading to the belief that these basins are connected below ground with faults or fissures, which have, no doubt, been gradually enlarged by solution of the limestone into a series of connecting caves.

The whole district, if the Malaga and Goo San areas be included, is within an area ten miles north and south by six miles east and west.

The Kotchiu Chamber of Commerce has regulations to the effect that all concentrate must be smelted in that city and consequently it is transported there by mule and horseback, or occasionally on pack oxen. Motor roads or a light industrial railroad could readily be built and routes are suitable for aerial tramways. Notwithstanding the low price of labor, the present transportation costs are high. It is probable that in the future foreign methods of transportation will be introduced.

An aerial tramway has been built between the Tin Company's treatment plant at Kotchiu and its mines at Malaga. It has been in successful operation for some years. It is operated in two



Washing Tin Ore at Kotchiu

sections, one a jig-back about 2,000 feet long from a high cliff overlooking the smelter, and another of continuous type two miles long and having one span 4,200 feet long.

The small horses or mules used cost about $150 Yunnan currency each, and a present rough figure for pack train transportation is $0.25 U.S. per ton mile; aerial tramway transportation costs about 1 cent U.S. per ton mile.

Topography

Much of the province of Yunnan is covered with Paleozoic limestone and this is the prevailing country rock in the Kotchiu district. The age then is probably Carboniferous.

All the tin mines are well up on the range of mountains separating the Mengtze plain from the Kotchiu valley. The range has been formed by granite intrusion or batholith of large magnitude along a general north-south course. The granite may be observed in place in the northern part of the district at Ber Sa Chong, on the eastern flank of the range, and on the trail between Kotchiu and Mengtze. It is also exposed about one mile north of Malaga and in the hills in a few scattered patches between Malaga and Kotchiu. It is not in evidence in the southern district.

Near Malaga the limestones are inclined to the north at an angle of about 25°, this inclination giving place abruptly at the mines to flat-lying beds, whose junction with the inclined strata is marked by a pronounced fold and a small minor fault. Faulting is much in evidence throughout the district, and from the position of the various limestone sinks, many of these seem to be joined by fault fissures enlarged by solution and erosion to cavernous openings which are sometimes surprisingly large.

The drainage of the Kotchiu valley, covering in all a probable area of 100 square miles, flows into such a cave on a well-defined fault at the power house of the Tin Company. The water reappears on the east side of the Kotchiu range on the Mengtze slope several miles away. These open fissures and caves are common in the various mine workings and have constituted an extremely valuable assistance in mining operations by providing natural ventilation and drainage. They are responsible in a large degree for the Chinese miners' ability to have worked the mines to depths of from 1,500 to 2,500 feet vertically below the surface, and though now and again "bad air" or water is reported in some long drift or dead end this is rare.

The lode deposits show few surface evidences. Malaga, for example, shows only one small veinlet about 2 or 3 inches wide and traceable on its strike for a few hundred feet. With its low-grade ore frozen to both walls, it has a tin content of less than 1 per cent, yet Malaga is a large mine. Similarly, in the southern area, most of the mines show no surface indications other than perhaps a minute seam, yet it is rare to note a mine with workings of less than several thousand feet in extent underground. One exception to this phase is a promising looking brecciated and iron stained outcrop about 30 feet wide and 200 or 300 feet long, a few hundred yards north-west of the village of Hwa Mao San. A small amount of surface work has been done there, but this outcrop has not yet been correlated with any existing mine of note. A few hundred feet away three different mines furnish employment to several thousand men. None of the three has anything to distinguish it on the surface as being worthy of extensive development. An unusually high-grade mine near Wang Tse village is similarly devoid of surface indications of a promising nature. On the whole, it may be readily believed that only the wealthier operators or groups in co-operation could afford to take the chances of such apparently haphazard exploration. It is noteworthy, however, that in distinction to western mining camps in the United States, there appear to be few "abandoned mines." There are, as might be expected, dozens of Tso Be Tungs (grass root tunnels). In accordance with the name these rarely go in more than 20 to 30 feet and cannot be said to have thrown any light on the existence of workable ore deposits.

Ying Miao Street in Kotchiu

Restrictive Regulations

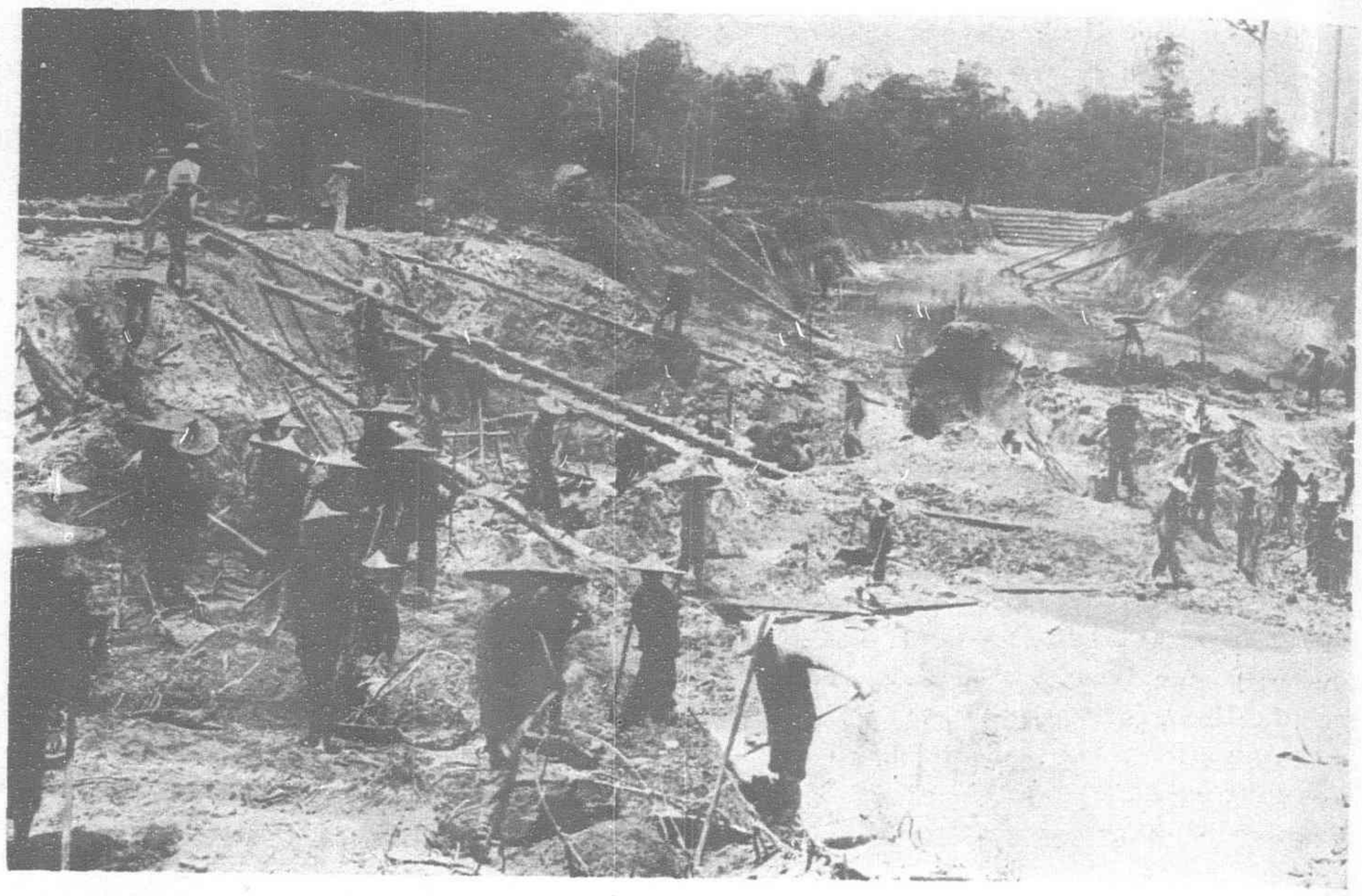
Aside, however, from the paucity of surface indication, there is a reason to be found in the mining regulations themselves for the possible non-exploitation of apparently favorable mining territory. These, though somewhat vague and conflicting from a foreign viewpoint, are explicit enough along some lines. One commonly accepted usage is that any man sinking a drift (all "shafts" or other workings openings are sunk invariably at an angle of 30° in order that the carrying coolies may bring up loads of ore on their backs) has the sole right to work the ground which he has opened. As the workings from the main shaft expand, the original shaft sinker grants lessees rights for further exploitation by branching drifts, winzes and the like, and these lessees in turn extend the same privilege to others, so that eventually the whole enterprise becomes a highly involved and intricate undertaking with many interdependent and co-operative but conflicting interests. Naturally, in the case of a prosperous mine being opened other shafts would be sunk near by, and where one miner holes into the workings of another, each, under the terms of this vaguely defined usage, not unnaturally claims not only the ore he was engaged in mining, but the ownership of, and consequently remuneration for that already extracted nearby. It is known that many bloody battles were fought underground over this issue, which must have been much more common in the earlier days than at present. The weight of wealth, precedent, numbers and authority of older owners would be almost certain to allow them to prevail over the newer miners, and this fact probably accounts for the natural reluctance to start any new exploitation shafts and the evident scarcity of such operations in localities known for the extent and ramifications of the deposits underground.

Underground, the ore is followed by crooked, tortuous inclines, and it is seldom indeed that any dead work of any kind is done other than widening out a narrow drift by blasting the limestone walls. Stopes having been exhausted, it is common practice to stow the mouths of drifts leading to the stopes and to timber past the location. As no surveys or other records are kept, the knowledge of the location, extent and tenor of such orebodies is ultimately lost, to the obvious detriment of the operators and industry as a whole. For this reason, surveys of present day workings give only a vague idea of the extent or habit of the orebodies other than those being worked at the immediate present, and maps wrongly give the impression that the orebodies are worked only by drifts. No ore is ever blocked out and it is unusual to see development work in progress beyond the vicinity of a good working stope.

Occurrence of Ore

The Tin Company, having a more enlightened outlook, has employed foreign engineers, equipment and, to a less extent, methods. Its Malaga mines are surveyed from time to time, so that from these data together with more cursory investigations of other mines much valuable information has been obtained. These show that a common occurrence of the ore is that of linked sausage deposits following usually a more or less well-defined strike. However, there are also pipe-like deposits, and occasional irregular replacement deposits of large extent where the filling of a cavern makes a really large orebody. One such, in the Malaga workings, was 100 feet high, 80 feet wide and 120 feet long. Others have been reported from the southern district several times this size. A very common occurrence in the Malaga mines is that of beds of from five to 30 feet thick, conformable with the bedding planes of the country rock, and thinning out laterally each way from what is evidently the fissure furnishing the mineralizing solutions. These may have a working width of 30 or 40 feet, the margin merging usually through clays of residual origin into unaltered limestone. Surveys clearly show that the permeability, solubility, or possibly the precipitating power of particular beds of limestone account for the persistently recurrent beds of ore on a specific horizon. At least three such favorable planes are known in the Malaga mine, and there are less substantiated grounds for belief that there are several others. There are, in addition to this type of orebodies, those branching and ramifying deposits which extend in all directions, which are commonly found in limestone replacement deposits. Sometimes the fissures are well defined, but the tendency of the orebodies as a whole is to make ore along the limestone bedding planes rather than to replace the fissure walls, which are at best not usually well defined.

The genesis of these orebodies is clearly attributable to the granite batholite which, having faulted and fissured the overlying limestone, then, by its emanations of ascending waters saturated with iron oxide, tin, copper and small amounts of lead and arsenic, mineralized the openings by depositing the ore in the limestone in lessening amounts as the surface was approached. I have failed to find any evidences of migration or secondary enrichment at either varying localities or depths.



Tin Mining Operations

Pumping water for Ore washing at Kotchiu

The ores are remarkable for their uniformity as the different mines show little variation in the principal constituents. Typical analyses of the crude ores are shown as follows :

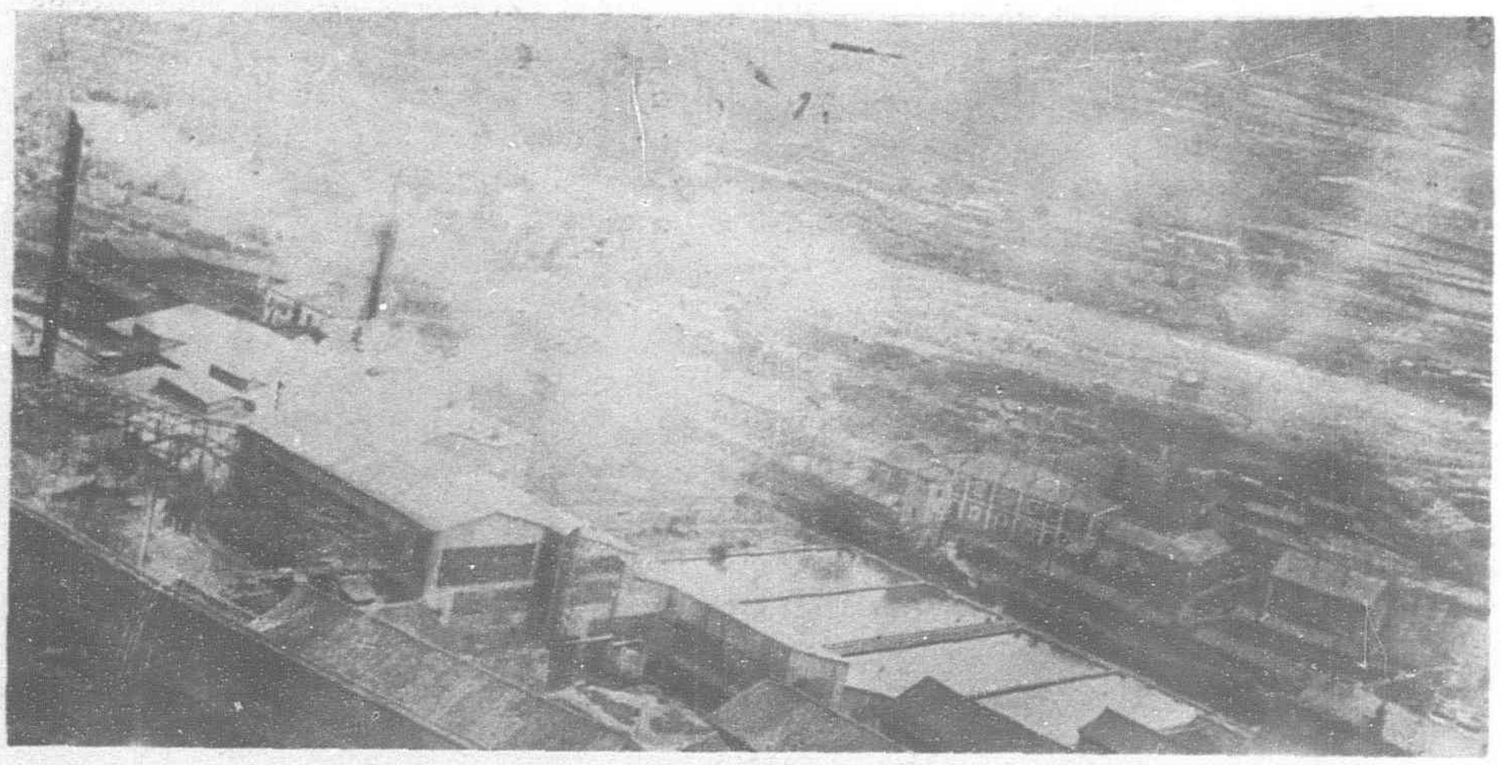
No. 1 is the result of sampling 12,000 coolie loads of the current output of the mines at Malaga in 1920.

No. 2 shows the analysis of a composite and properly weighted sample obtained in 1923 during a detailed census and sampling of all of the principal mines of the district.

	No. 1	*No. 2*
Sn calculated to SnO_2	8.80 (6.94 Sn)	6.70 (5.28 Sn)
Al_2O_3	10.30	14.37
Fe_2O_3	54.00	54.30
CaO (Cal. to $CaCO_3$)	6.84	16.68
As (Cal. to As_2O_3)	3.38	2.05
Cu (Cal. to $Cu_2(OH_2)CO_3$)	4.20 (2.41 Cu.)	2.17 (1.25 Cu.)
Pb present as cerussite	Tr.	Tr.
Zn present as carbonate	Tr.	Tr.

Analyses in 1927 corroborate the above. But lower levels in the Tin Company's mine showed then increasing amounts of copper carbonate—malachite.

The average grade of all crude ore for some years has been well above 5 per cent contained tin, and continues at this grade now.



Plant of the Kotchiu Tin Mining Company in Yunnan

Placer Deposits

These in the Kotchiu district are usually confined to the limestone sinks and are due to the solution of the limestone *in situ* over long periods of time, wherein the cassiterite in scattered veinlets, seams, and patches in the limestone, gradually settled vertically and the mineral is now found in the bottom of the sinks together with the residual clays due to the decomposition of the limestone. The processes of erosion, such as mechanical concentration by running water, have had little or no part in such concentration of the cassiterite.

In this respect, the placer deposits are analogous to those in the Federated Malay States, though mechanical concentration there has been, I believe, a greater factor through later geographical

periods. Concentration of minerals by solution of inclosing limestone is a common one in Yunnan, where Paleozoic limestones cover much of the province. Even so friable a mineral as cerussite occurs in many places in the sinks of Yunnan and the deposits are placered for lead and silver. Concentration may be said to have progressed vertically rather than laterally.

The 200 or more placer pits or areas in the Kotchiu district have thus all been formed by this solution-in-place process with the remaining cassiterite imbedded in the residual clays of the limestone, and with the exception of an occasional side of a limestone bank having been eaten out by latter-day stream beds, all in sinks. Many areas between the rough limestone pinnacles on side hills have also been worked for the cassiterite, but production from them has formed only a small part of the placer output. Only a few sink deposits are being worked at present. The uniformity of the tin content in the placers has given rise to the belief of former Chinese operators that placer workings as opposed to lode mining, presented less hazards. Owing to the absence of detailed Chinese records, there is little on which to base an idea as to original content, but from latter-day operations, it is safe to say that the content rarely exceed 2 or 3 lbs. of cassiterite per cubic yard, with the probable average of less than 2 lbs.

Mining Methods

All these deposits are mined by open pit by coolies who, with a carrying pole and bamboo baskets suspended from its ends, carry their loads of dirt from the side and bottom of the pit up inclined trails to the washing pits on the surface. Here, water collected from the seasonal rains is used to concentrate the ore, which is done in sluices to rough wash the gravel, followed by treatment on "planillas" or inclined planes to clean the contents to smelting grade.

The relatively limited tonnage, scattered location, their inaccessibility to water, the topography and finally the low tenor of the alluvial deposits, all combine to prevent the installation of commercially successful modern placer equipment. These open-pit workings are now only interesting from a geological and historical viewpoint.

Notwithstanding the dense population of China, mine labor at Kotchiu is scarce and difficult to obtain, for it is generally known that the work at Kotchiu is arduous and dangerous. Consequently, labor agents are employed at all times to enlist men from various parts of the province—sometimes as distant from Kotchiu as 20 or 30 days' travel. For the most part, the mine coolies are from 12 to 18 years of age, parents or other relatives being sometimes given a bonus for a minimum period of six months' work at the mines. The boys are taken in charge at their homes by the agent, who transports them to the mines and there soldiers are stationed to prevent their escape before their time has expired. They are housed in thatched roofed stone buildings. Their food consists of rice, vegetables and at rare intervals, pork or other meat. The accommodations are furnished free. The boys receive this in addition to their wages, which average about $12 Yunnan per month (at present exchange $2.50 U.S.). At present the daily cost per man is roughly $1 Yunnan, or $0.16 U.S. The miners as well also as all the other employees, participate to an extent in bonuses which, in the case of a paying mine, are distributed at the Chinese New Year in February.

Three shifts of eight hours are worked in the mines. Different parts of the mines are allocated to the various foremen, who are in turn responsible for a specified output of ore.

Eighty per cent or more of all underground labor is engaged in carrying ore up the long, narrow and tortuous inclines so that the mining cost is in reality largely a transportation cost. A daily task for these coolies consists of about five round trips down a 30° incline 2,000 feet long, and the average load carried is 67 lbs., this being the average of some 12,000 loads. One man, therefore accounts for the production of one-sixth of a ton per day. The ore being soft, caves readily, so fatal accidents are frequent. Mortality is very high—I doubt if it is equalled at any other place in the world. But it is not due to the causes commonly assigned to it by the various Chinese officials, who have commented in official communications to the Government regarding the matter—namely, to poor air and bad ventilation. As a matter of fact, as mines go, ventilation is usually good and the air is commonly as good as in deep level mines in the United States.

Except in the mines operated by the Tin Company no surveys or similar records are made. I have known of cases where parallel drifts nearly 1,000 feet long have been run within 40 feet of each other. Supervision, bonuses and various other charges bring the total cost of production up to a point averaging $15 and $25 Yunnan ($2.50 to $4.25 U.S.). The cost of laying down on surface one ton of 5 per cent ore will not exceed $5 U.S. per ton.

Crushing

On the surface the ore is delivered to storage and disintegration patios adjacent to water storage tanks. The patios are merely level spaces with usually a tamped clay floor. On these the ore is spread out a few inches in thickness, and coolies equipped with a crooked tree bough cut as a club or flail pound the ore to disintegrate it and prepare it for washing. Most of it readily falls apart, making a granular sandy product. About 10 per cent of the total is slightly more siliceous and hard and, not disintegrating readily, is piled up for further crushing by foot stamps or large Chilean mill wheels about two tons weight. A water buffalo, harnessed to the outer end of the horizontal axle, furnishes the motive power. The crushing is well done but is slow and expensive. Nearly all of these buffalo mills are in the town of Kotchiu, being largely used for crushing slag from the native tin smelters, the ground slag being concentrated on the planillas for its tin content. The cost of crushing by this means is about $2 U.S. per ton.

The pounded-up ore at the mines is treated on the washing planes, being washed to a rough concentrate containing from 50 to 55 per cent tin. Apparently a simple enough operation, yet the various products being many times re-treated, it results in a rather intricate flow sheet.

Wet Concentration

The planillas used have a bed 5 feet wide by 6 feet long, made of burned clay brick. The bed is set at an incline of about 20° from the horizontal when used for rough washing, in which operation large quantities of water are thrown on the base of the pile with a sluicing motion. As the tenor and fineness of the material increases, it is treated on other planillas with greater inclination and lessening amounts of water, so that when fine slime or finely ground slag is treated, the inclination is as much as 45°, and only a thread of water is flipped on the material with a small bamboo.

Another method also in common use is to confine the crushed ore in a sluice-like box, some 2 feet wide and 8 or 10 feet long, set on a 10° slope. By means of a broad wooden hoe, one or more coolies at the lower end of the sluice (which is dammed temporarily for the purpose) works the ore up and down, producing a jigging motion, causing the fine and light material to flow over the lip of the board dam and the heavier material to remain.

By combinations of these methods, the various products pass from one planilla operation to another, middlings and tailings being many times re-treated. The operators are always loath to discard tailings and they are often piled up for later re-treatment when a higher price for metallic tin gives the necessary margin for profit.

No matter how finely the ore is comminuted for treatment, iron oxide films will still adhere to the cassiterite grains; the various middling products thus made by the native methods are increased, for the ore receives no crushing other than the first flailing. This feature accounts for most of the losses in concentration and for the many times it is re-treated by washing.

From screen analysis it appears that about 90 per cent of the cassiterite is liberated at—65 mesh, and little clean cassiterite is obtainable at about 20 mesh. Clean concentrate varies from dark brown to brownish black in color. That from the placers is invariably much darker in color, being usually black. An average extraction of about 70 per cent is obtained by these methods. The cost of ore concentration alone, not including the cost of crushing, which is nominal, varies from $1 to $2 U.S. per ton.

The unit of measure for concentrate is the "toung," a cylindrical measure containing 0.93 cubic feet and averaging in weight 132.84 lbs., as determined from 36 individual tests, thus closely approximating the picul of 133.33 lbs. The toung is a unit of capacity, not of weight, however. Depending on grade, a toung of concentrate therefore varies considerably in weight. The toung is filled by hand by a peculiar rotary and shuffling motion of the hands

and the concentrate thus measured has been previously dried in the sun to about 7 per cent moisture content. Notwithstanding the obvious inexactness of this unit, it is in common use for transactions between producers and local customs smelters. All the mines reckon their costs on a toung basis and take no account of crude ore units. It is very difficult, therefore, for a foreigner to get exact data.

Fortunately, all ores are thoroughly oxidized and nearly all of the copper occurs as carbonate, the arsenic as oxides and the lead as carbonate; they are slimed and remain in the tailings. The lead alone constitutes an impurity of importance in smelting, as by reason of its specific gravity notwithstanding the cerussite is so easily slimed, some of it goes over into the concentrate. Placer concentrates are sometimes high enough in lead to make them locally unsaleable. About fifteen years ago some placer operations were ordered discontinued by local authorities on account of the high lead content of the concentrate. Present-day operations are not at all hampered by any unduly high lead content. The ratio of concentration from crude ore to finished product varies from 12/1 to 15/1.

The following analysis is fairly representative, being the average of twenty-seven lots from various parts of the district.

ANALYSIS OF CONCENTRATES

SnO_2	87.3 (Sn 68.7%)
SiO_2	2.0
Fe_2O_2	8.1
Al_2O_3	0.8
$CaCo_3$	0.6
$Cu\ (OH_2)\ CO_3$	0.3
AS_2O_3	0.4
Pb	Tr.
Sb	Tr.
Zn	Tr.
	99.5

Seventy-five other determinations on various concentrates gave an average of 68.53 per cent Sn.

In order that taxes can be imposed, local regulations require that all smelting must be done at Kotchiu. Rough concentrate carrying 50 to 55 per cent tin is brought by mules from the mines and re-treated at Kotchiu to bring it up to a content of 68.5 per cent tin.

Smelting Organization

There are said to be about 150 operating companies in Kotchiu, most of these being small, corresponding in degree to lessees in western mines in the United States. Of the total number there are probably forty large companies having their own smelting plants equipped with one or two furnaces, slag crushing plant and other accessory equipment. A few plants, not more than ten, do custom smelting. There are in all about fifty smelting plants in Kotchiu. With little variation, the equipment and methods are the same. The plant usually consists of two furnaces, one being is operation while the other is being relined or repaired. An adjoining house contains one or more of the large buffalo-drawn Chilean mills for crushing slag. A few houses for the working coolies, with more pretentious ones for the owners, complete the establishment, the whole being surrounded by a compound wall 8-ft. high.

The shaft furnace for smelting operations is being built of locally burned bricks and lined with clay. It is about 4-ft. by 2-ft. in cross-section at the top, gradually tapering to the bottom, where the tuyère for the blower is inserted. The blower is made from a bored-out log and is 14 ins. in inside diameter. A wooden piston whose stroke is about 4 ft. is inserted. Leather flap valves are placed on top at about the center of the log. The piston is double acting, packed with chicken feathers in an outside stuffing box and lubricated with wax. The crew consists of three men per shift, who alternate in pulling the piston in and out. The blower is simple and effective, but from a Yunnanese viewpoint expensive as, due to the scarcity of wood of any kind, a good blower costs $800 Yunnan or more.

The furnace is charged with alternate layers of charcoal and charge, the latter consisting of 90 per cent concentrate and 10 per cent more or less of shot tin from re-crushed slags. To keep the top of the charge hot, a layer of less expensive dried or partly charred wood is put on. This, in sinking, also becomes charcoal and goes through with the charge. From time to time a layer of concentrate followed by charcoal and dried wood is put on as the original charge sinks to the smelting zone at the tuyère. In front of the furnace a coolie, with a 10-ft. switch of a wood allied to willow, which is somewhat fire resisting, pokes continually to keep the tap slot open. This is 1½-ins. wide by 5-ins. high. The slag and molten tin issue, as fast as formed, in driblets, with small gushes every few seconds. The outgoing material is collected in a clay-lined pool in front of the furnace. To keep this hot, it is covered with a layer of fine charcoal. When some 200 lbs. of tin has collected in the pool, the charcoal, mixed with blobs and stringers of slag, is raked back and quenched in water. The tin is ladled into a shallow basin. After a few minutes cooling in this basin to a proper casting temperature, it is ladled into casting moulds of sand arranged in tiers. The slabs have sloping sides and are 2½-ins. thick, 9-ins. wide, and 18-ins. long. They weigh about 70 lbs. and are in form for local sale. The tin undergoes no refining. The bars are skimmed while still molten in order that the "star" or surface crystallization may be visible to the buyers. There is little uniformity of grade, each bar differing in composition from the next following. There has been no mixing other than in the three-bar pot, from which the moulds are filled.

The quenched slag is taken to nearby washing sluices, the largest pieces being about ¾-in. in diameter. It is screened on a coarse screen and most of the charcoal thrown out for re-use, and is then raked over with wooden hoes in the washing sluices and the coarse shot tin partly shaken out. That material is returned to the charge floor for re-smelting. The first slags as they come from the furnace have a content of 28 to 35 per cent tin.

The coarse slag tailing resulting from the concentration operation just outlined, is ground in a buffalo mill, and again returned to the concentration planillas. The fine shot is returned to the charge floor for re-treatment, and the resulting fine slag, averaging 18 per cent tin, is piled up for sale to local dealers. They crush it finer and reduce the content by 1 or 2 per cent of the tin. The slimed slag tailing, still carrying 15 to 18 per cent tin, goes to waste.

No flux of any kind is used in the smelting operations. There is an apparent loss by volatilization, though it is probably small. Each furnace has a capacity of about 1.25 tons (of 2,000 lbs.) of metallic tin output per day.

Costs of Native Smelting Per Ton of 2,000 Lbs. of Tin Slags Produced Yu. Cy.

1923.		*1928.*	
Charcoal, 4,500 catties (of 1.33 lbs.) at 4.5c. Yu. Cy. ..	$112.50	Charcoal, 4,500 catties at 12c.	$540.00
Labor	16.08		20.00
Taxes..	57.07		57.07
Slag crushing and concentration	13.39		18.00
Incidental	0.83		2.00
	$199.87		$637.07
In U. S. Cy. (1921-22) Exchange at $0.41		In U. S. Cy. (1928) Exchange at $0.16	
U. S. Cy.	$80.95	U. S. Cy.	$101.92

Charcoal, universally used in the district for fuel, has become increasingly expensive through the last ten years. Timber in Yunnan is found only in isolated places, most of it having been cleared off a hundred years ago. It is now only a question of a few years at most when smelting with coal will be necessary.

The Tin Company

The Yunnan Kotchiu Tin Trading Co., owned and operated by the State Government of Yunnan, is the largest individual producer in the district, producing over 10 per cent of the annual output. It is locally designated as "The Tin Company" and has been so referred to in the previous pages. A charter, covering a period of thirty years, was granted by the Imperial Manchu Government at Peking (recently re-named Peiping) in 1908. It

was capitalized at $2,000,000 Yu. of which the State subscribed $1,260,000, and the local mine owners and capitalists $740,000. Later on, most of the latter amount was refunded to the people, so that the provincial government is reported now to own about 98 per cent of the Company. The officials of the Company, including the president, vice-president and the board of directors, are appointed by the official governing heads of the Province.

In 1910 the Company was reorganized and a contract was given to a German firm to erect a 400-ton concentrating mill, a tin smelting plant and buildings at Kotchiu. These were completed about 1914, together with a five-mile aerial tramway to the southern district. War was declared with Germany about this time and the German engineers, who had just completed the plant, returned home. The plant was barely turned over, and the tramway had not been operated. The plant was designed to be sufficient to treat all the production of the district, and to supplant the costly and wasteful native methods by those of greater known efficiency practiced in other countries. Little was done with this plant until 1920, as the Company had no producing mines of note in the southern district and necessary arrangements had not been made with the other operators there to treat their ores.

At this time it was decided by the Yunnan Government to have an examination made of its various mines in Yunnan, and H. Foster Bain and myself were engaged for the purpose. Having completed these examinations, the author was then engaged as chief engineer of the Company to rehabilitate and direct various changes. During the following two years, although the Company was troubled by changes of management caused by political disturbances, the tramway was moved to connect the Company's mill and its mines at Malaga. This mine had been started some four years previously. The smelter was operated and the mill was put into operation.

In 1926, the author was again engaged as chief engineer for the Company. The mill was overhauled, re-equipped with a Marcy roller mill, tables, etc., and a new power plant with electric drive for all machinery installed. A centrally located deep working shaft was started at Malaga, tractor transportation was introduced, and various other changes made so that the Company is now prepared to operate under foreign methods for the first time.

The power plant consists of two 250-h.p. Babcock and Wilcox boilers with economizers and induced draft, and a 300-kw. generator coupled direct to a Uniflow engine and equipped with condenser and feed water heater. This will furnish power for mill and smelter, and a transmission line 2.5 miles long to Malaga takes power there, which will be used for running a double drum hoist and a small compressor. A vertical three-compartment shaft has already been sunk by hand to a depth of 200-ft., and is so located and designed as ultimately to serve the lowest workings, which are now about 1,700-ft. vertically below the surface.

Underground Workings

The shaft has two 4-ft. by 6-ft. hoisting compartments and a ladderway. The latter had staggered ladders with platforms at 10-ft. intervals. The dividers are 12 lbs. steel channels and steel angles bolted to the dividers hold 2-ins. Oregon pine lagging. This is painted with asphalt before being put in place. Since the shaft is mainly in hard limestone, not much lagging will be required. It is interesting to note that since the timber supply in Yunnan is remote and transportation by pack mules expensive, a comparison of relative costs showed that, all things considered, Oregon pine was the cheapest material for head-frame and other construction, and was accordingly used. Sullivan sinkers and Chicago pneumatic drifters are used.

The shaft is so placed that the ore is dumped from the cage cars into receiving bins of 500 tons capacity and can be trammed in the tramway buckets, holding about 1,600 lbs. of ore, on an overhead rail to the tramway terminal a few hundred feet distant.

An engine house, staff quarters, warehouse, blacksmith shop, and other buildings have been erected at Malaga. All these, together with the receiving bins of 800 tons capacity, are built of white or variegated marble quarried near by. All the buildings are inclosed within a stone compound with a wall 8-ft. high, with the usual stone watch-towers provided for the soldier guard against bandits.

The Company's operations at the Malaga mine are subdivided into two departments, one a Chinese engineer having charge of the operations involving the use of foreign methods of hoisting, shaft-sinking, tramway, terminal operations and the like, and another having charge of the operations which involve purely Chinese methods of ore extraction through the old inclines, Hsin Tung and Lao Tung. Under the latter there are fifteen or twenty foremen in charge of specific mining areas underground.

The Company has about 2,000 men working at Malaga. Most of these are employed in underground mining through the old inclines, Lao Tung (Old Shaft) and Hsin Tung (New Shaft). However, several hundred of the 2,000 men are engaged in concentrating the ore, rough washing it to a crude concentrate for shipment over the tramway to Kotchiu.

The aerial tramway, operated by gravity, has a capacity of about 400 tons daily. The total length of thet ramway is 12,800-ft. gaining an altitude from mill to mine of 2,100-ft.

By reason of the dip of the orebodies, the deposits at Malaga as a whole are not well adapted to exploitation by vertical shafts, since the drifts and cross-cuts will be relatively long. But the rough topography, limiting a choice of shaft location, the already existing location of tramway terminals, and finally, the probable existence of parallel orebearing horizons other than those already developed, all combine to determine the choice of a vertical, rather than an inclined shaft.

When the mill is in operation, it is possible to send crude ore over the tramway, eliminating rough washing operations at Malaga and the necessity of using the steam pumps at Kotchiu for furnishing water to Malaga. The pumping unit used for the latter consists of two Worthington triple expansion steam pumps, run condensing, built of an output of 500 gal. per minute and operating against a head of 2,200-ft. The pipe line is 7-in. in diameter and about four miles long. The pumps are now principally used for furnishing domestic water to Malaga in the dry season.

From the lower jigback tramway terminal, the Malaga ore is discharged into a masonry bin of 100 tons capacity, and thence trammed to the top floor of the mill.

A series of four rectangular settling basins, each about 40-ft. by 250-ft. and 10-ft. deep, is arranged on the bottom level outside of the mill to settle tailing. From these the clear water is returned by means of a centrifugal pump to steel storage tanks on the top floor. Other mill water is taken from the main storage reservoir, which is built of masonry at the point where the Kotchiu drainage bows into a cave. It holds about 20,000,000 gal. and a small boiler and pumps have been placed there to send it to the mill. Hereafter the pump will be motor-driven.

Originally, eight jigs were provided. These have now been discarded as they were unable to make clean product on the finely divided cassiterite. Considerable space has been left for possible changes in re-treatment of various table products and it is probable that additions looking to greater efficiency in the treatment of fine slimes will be warranted. The capacity of the present plant is about 300 tons per day. It can be largely increased as needed by putting in primary crushing and grinding units.

The smelting plant is in a steel building adjoining the mill, and has a floor space of 200-ft. by 80-ft. It houses three gas producers, each furnishing gas fuel for one pair of reverberatory furnaces. The fuel, which is Yunnan coal, is trammed in wheelbarrows from adjacent elevated coal bins.

There are six reverberatory furnaces. The hearth of each is 13-ft. long by 7-ft. wide, with a hearth area when the furnace is newly lined of 75 sq. ft. Each furnace is equipped with an auxiliary chamber containing firebrick checker work for heat conservation and regeneration.

An 18-in. gauge track, laid from the scales at one end of the building, runs lengthwise through the building and out to the slag dump patio beyond. On one side are the producers and reverberatories.

On the opposite side are three liquating furnaces, a 36-in. circular blast furnace for slag treatment and four mixing and settling pots 5-ft. in diameter, arranged in two sets of three each, each set being equipped with one fire-grate for two pots.

The concentrates mixed with charcoal or coal for reduction are charged with silica or other necessary fluxes through three charging doors, two on the side and one on the end of the furnace. When fusion is complete the furnace is tapped, discharging all of the tin and slag together into a receiving kettle 4.5-ft. in diameter, where it is allowed to cool partly. Just before the slag solidifies a wrought iron eye is placed in the slag, and when the latter has

solidified it is lifted off the still molten tin with chain blocks and trammed to the slag dump to be later broken up by hand hammers for re-treatment. The molten tin is then cast in iron moulds into bars of about 70 lbs. each. These are re-melted in the mixing and settling pots and after going through some of the usual refining processes are again cast in flat slabs in sand moulds, the final bars also averaging about 70 lbs. in weight. The plant was originally designed with a capacity sufficient to treat the output of the district, each furnace being supposed to treat 10 tons of concentrate per day with some leeway for units being concurrently repaired. The grade of the metal turned out by the Tin Company's furnaces is about the same as that produced by the tin obtained by native operations.

The fuel used in these gas producers is coal mined in Yunnan, and is obtained both by purchases from Chinese coal mine operators from different localities along the French railroad, and also from the Tin Company's coal mine four miles from the railroad, at Niogo near Ami Chou. The latter is 70 miles from Kotchiu. The company now contemplates using tractor haulage from the coal mines at Niogo to the railroad. Operations have been much impeded by the difficulty in obtaining coal for the smelter and power plant. For this reason two native furnaces using charcoal are kept in operation much of the time for smelting concentrate.

The plant and administrative buildings are all enclosed in the compound of the Company—an area of some 125 acres, which is surrounded by a high stone wall and guarded by about 200 soldiers at all times. The plant includes a well-equipped machine shop and iron foundry, and exceedingly good work is turned out by the local operating staff, the workmen being Cantonese recruited usually from the various shipyards at Hongkong where under British superintendence mechanics, electricians, and foundrymen have received thorough training. Practically all accounting is done in Chinese.

In buildings adjoining the mill is the old steam power plant for mill and smelter. This is now held in reserve for emergencies, having been superseded by the electrical power plant about one-quarter mile distant. A good power line has been erected to connect with the principal mines of the Company at Malaga. Power is sent at 6,600 volts and stepped down at the mines to 440 and 110 volts for different uses.

The principal officers of the Company are the president and vice-president, both of whom are appointees of the State Governor of Yunnan, and in whom are vested the operating responsibilities. A board of directors of the Company functions nominally but final decisions are largely in the hands of the two officials named.

Roads have been constructed from the railroad station about one mile away and to the power house, and Fordsons and trailers transport tin, fuel and supplies. The men have already become expert in operation and repair of the equipment in use. Road graders and similar equipment are also used.

Transportation elsewhere in Yunnan is done by pack mules. Notwithstanding the favorable conditions and the low wages paid men, transport as tabulated by me at intervals of some five years apart, comes to about 25c. U.S. per ton mile. This is well understood by the Chinese and the Government has already begun road building.

The Company had in the southern district, two or three mines of former note as producers, but which are not now of much importance due in large part to the difficulty of operating without adequate ventilation. With the adoption of more modern methods, these could perhaps be made of similar importance to the northern mines.

About 2,000 men are also engaged in what has hitherto been a placer operation at Goo San, three miles east from Malaga and at the western edge of the Mengtze plain. Here recently it is stated that the source of the placer material has been traced to what is presumably a continuation of the Malaga bedded deposits, and lode mining is being begun. Despite the large number of men employed in these placers, all of which were conducted by hand labor and Chinese methods, the output is only a fraction of the ore produced by underground mining. The outlook for extension of lode mining and consequent increase in output is promising.

Most of the production of the Kotchiu district comes from about fifteen principal mines, practically all of which are opened by the long tortuous inclines.

Some fifteen principal operating companies are engaged in this work. There are also about 120 smaller companies corresponding much to our own leasing companies. These operate various blocks or areas in the different mines controlled by the larger companies. These small companies are unstable and in time of lowering tin prices, they sometimes cause much trouble to local authorities as they go bankrupt. Failing to get their pay, the miners then often resort to banditry. This is the reason why it is customary in the district to employ soldier guards in number corresponding to the scope of the particular operation. The Tin Company has some 400 or more soldiers employed; to guard the town, a much larger force is always needed and engaged.

Mine coolies are housed in grass-thatched mud-walled buildings at the various mines. There are some 16,000 mine workers so employed in the various operations in the district and a large number in concentration and smelting. Kotchiu is the supply center and has a large number of native shops of all kinds. Probably 60,000 people depend on the tin industry as a livelihood. In times of high prices for tin the local population is said to rise to 100,000.

The tin industry is by far the largest in Yunnan, as is evidenced by the data obtainable from the Chinese Maritime Customs, a service officered by foreigners to collect all export and import dues and through which organization all commodities must pass. These statistics show that 90 per cent of the value of all exports from Yunnan consists of tin slabs. The Customs tax is very small —about $\frac{3}{4}$ of 1 per cent. Local taxes are many, intricate and confusing as they include many items and depend on many varying factors and unrelated units of measurement. Some of the tin is sold to the resident agents of Cantonese refiners, whose plants are in Hongkong. The local taxes are borne partly by the buyer and partly by the seller. An approximate figure for them is about 3 to 4 per cent of the total value of the tin.

Since the completion of the Kopi Railroad from the main line to Kotchiu local people have had some contact with foreigners. Principal imports into Kotchiu are charcoal for tin smelting, but the railroad follows a circuitous course of some 45 miles on severe grades. Many expensive tunnels were necessary and the cost of operation under entire Chinese management is high. Freight tariffs are held to the same competitive rate that the mule trains charge, so that the preference of the local smelter owners is to deal with the mule men rather than the railroad, since charcoal can be laid down at the smelter instead of the station at the same price.

The railroad serves no particularly useful purpose. It was constructed from the proceeds of a local tax imposed on tin and these taxes have not been annulled, though the road has been completed and in operation for several years. A good auto road can be constructed at low cost and with nominal grades most of the route being over the Mengtze plain. Such means of transport is much more adapted for the needs of the district and is a logical and shortly to be expected development. The total length would be 25 against 45 miles by the railroad.

Owing to the absence of surface indications, the relatively large area over which tin deposits of importance occur and the high iron content of the ores, it is possible that geophysical prospective methods can be used to advantage.

The Province of Yunnan is traversed by many north and south ranges of mountains, and in the past has been noted for its production of metals of various kinds, including gold, silver, lead, zinc, copper, antimony, mercury, cobalt, tin and other metals. While, like many of the deposits of American western States, many mining camps are now abandoned, it is possible particularly in the districts which have had water trouble, with which the Chinese could contend only by a series of "Chinese" pumps, that many would warrant close inspection. But any such contemplated operations must presuppose the existence of adequate transportation which at present at least is almost entirely lacking.

From time to time Chinese officials of the Yunnan Government have stated their desire to have their mineral deposits looked into by American mining men and have asked the author of this article to express this desire to representative mining men.

The outlook for continued increase of production of tin from Kotchiu district is promising. Many large economies are possible by the use of present-day machinery, equipment and methods, and the Chinese are now yearly becoming aware of the necessity

of changing their view-point as to the efficiency of foreign practices. Charcoal is now much more expensive than a few years previously and is increasingly scarce, so that necessity for the ultimate adoption of coal or coke for smelting is clear to the Chinese themselves. Fortunately for them, supplies of coal of good quality are available.

Although many of the tin mines have already attained depths which might cause a feeling of apprehension in the minds of American operators, none so far exhibit evidences of exhaustion or change of grade. Contrarily, all those mines which have come under the author's observation have invariably disclosed increasingly greater possibilities as the deposits were gradually exposed in mining operations. The fact that the mines have been worked for some 400 years is of little moment for the reason that extensive exploitation covers only the last 25 years.

All data hitherto obtained point to higher production for many years to come. Undoubtedly, greatly increased production could be had by the adoption at once of modern methods. Under Chinese jurisdiction, rate of increase will be slower.

Possibilities of Aviation

It is interesting in the light of the advance of aviation in America to consider possibilities in China. For the very reason of the previous backwardness of China it may be that she will be able all the more readily to adopt what up to recently has been considered as a rather hazardous and expensive method of transport. For some years past several airplanes have been maintained at Yunnan-fu, where, under French instructors, the young Chinese were taught the rudiments of flying. This department was maintained for purely military purposes and Chinese flyers have, during various of the fights between warring factions in Yunnan, played a considerable part. During the past year at least one quite modern American plane has been received at Hongkong by one of the young Yunnanese aviators and was flown from there to Yunnan-fu for the Government of Yunnan. The distance of some 500 miles overland was accomplished in a few hours. By steamer and railroad, the same trip *via* Haiphong takes from one week to ten days.

The author of this outline of tin conditions in Yunnan is indebted to many of the Chinese officials of the Government and the tin company for their unfailing courtesy and assistance. It is a pleasure to recall the enduring friendships formed with many of them and to note in closing a characteristic trait which we are much inclined to attribute to ourselves—namely, a saving grace of humor. To paraphrase an old adage it may truly be said that a "touch of humor makes the whole world kin."

Telephones in Chekiang

(Continued from page 482).

Li-yang, Kuyung, Tangyang, Chinkiang, Nanking, Pingfeng, Lili, Zung-tsu and Soochow are found among main centers of communication.

A five-year program has been set up by the Provincial Telephone Administration Bureau for the general extension of the existing lines. During 1930, the program called for the construction of the Ningpo-Chinhai line, the Wukang-Tehtsing line, Changshan-Siaofeng line, and the Kashing-Chapu line. Further plans are being prepared for the next four years to connect up all cities in the province with the long-distance telephone lines as well as branches hooking up the smaller towns and villages. The program for four years is outlined in order as follows :

1931 PROGRAM

	Line to be established	*Length in li*	*Cost of construction*
1.	Ningpo-Chinhai	35	$5,250
2.	Ningpo-Shihpu	145	21,750
3.	Kashing-Chapu *via* Pinghu	82	12,300
4.	Hangchow-Chapu *via* Changan, Haining, Haiyeh	180	23,425
5.	Changhing-Siaofeng *via* Meichi, Anchi .	120	18,000
6.	Chinghai-Pootu *via* Tinghai	—	—
	Line to be established	*Length in li*	*Cost of construction*
	a. Wire route	50	11,000
	b. Cable route	100	70,000
7.	Tunghsiang-Shihkow	30	4,500
8.	Wanling-Yuhwan	—	—
	a. Wire route	40	8,800
	b. Cable route	—	3,500
9.	Siangshan-Nantien	—	—
	a. Wire route	10	2,200
	b. Cable route	5	3,500
10.	Hangchow-Ningpo line, double wire system installation	265	22,525
	Total		206,750

1932 PROGRAM

	Line to be opened	*Length in li*	*Cost of construction*
1.	Wukang-Tehtsing.	28	$4,480
2.	Tunglu-Changhwa *via* Fengshui. ..	135	21,600
3.	Chuki-Luchi *via* Pukiang	250	40,000
4.	Yungkang-Linghai *via* Sienku	270	44,000
5.	Addition of wire over the listing system	500	42,500
	Total		152,580

1933 PROGRAM

	Items to be done	*Total length in li*	*Cost of construction in dollars*
1.	New double wire installation on long-distance telephone system	200	33,000
2.	Wire installation for smaller cities and towns	500	65,000
3.	Addition of wire on the existing long-distance telephone system	500	45,000
4.	Four engineering works departments ..	—	63,744
	Total		206,744
1.	New double wire installations on long-distance telephone system.	200	34,000
2.	Addition of wire on the whole system ..	200	19,000
3.	New wire installation for smaller cities and towns	200	27,000
	Total		80,000

The long-distance telephone services now installed in Chekiang are very popular with the general public, particularly the merchants and business men. The charge for each call varies with distance. In addition, a notification fee is charged for notifying the receiver who lives at some distance from the' phone, and a "over wire fee" is charged for establishing connections with city telephone service at places to which the government service has not yet been reached.

Sugar Refinery for China

Dr. H. H. Kung, Minister of Industry, questioned about the reported establishment of a large-scale sugar refinery in Shanghai by Chinese and Cuban interests, stated that the Ministry and the Cuban sugar interests have signed a draft agreement for the realization of the project.

The proposed company, according to Minister Kung, will be capitalized at G$5,000,000 with its head office at Shanghai. The Cuban interests, he said, represent Cuban sugar producers and are in no way connected with the Cuban Government.

Dr. Kung said that sugar occupies second place in the list of commodities imported by China (cotton yarn being first) and that the average consumption of sugar per capita in the country is at present only from 30 cents to 45 cents.—*Kuo Min.*

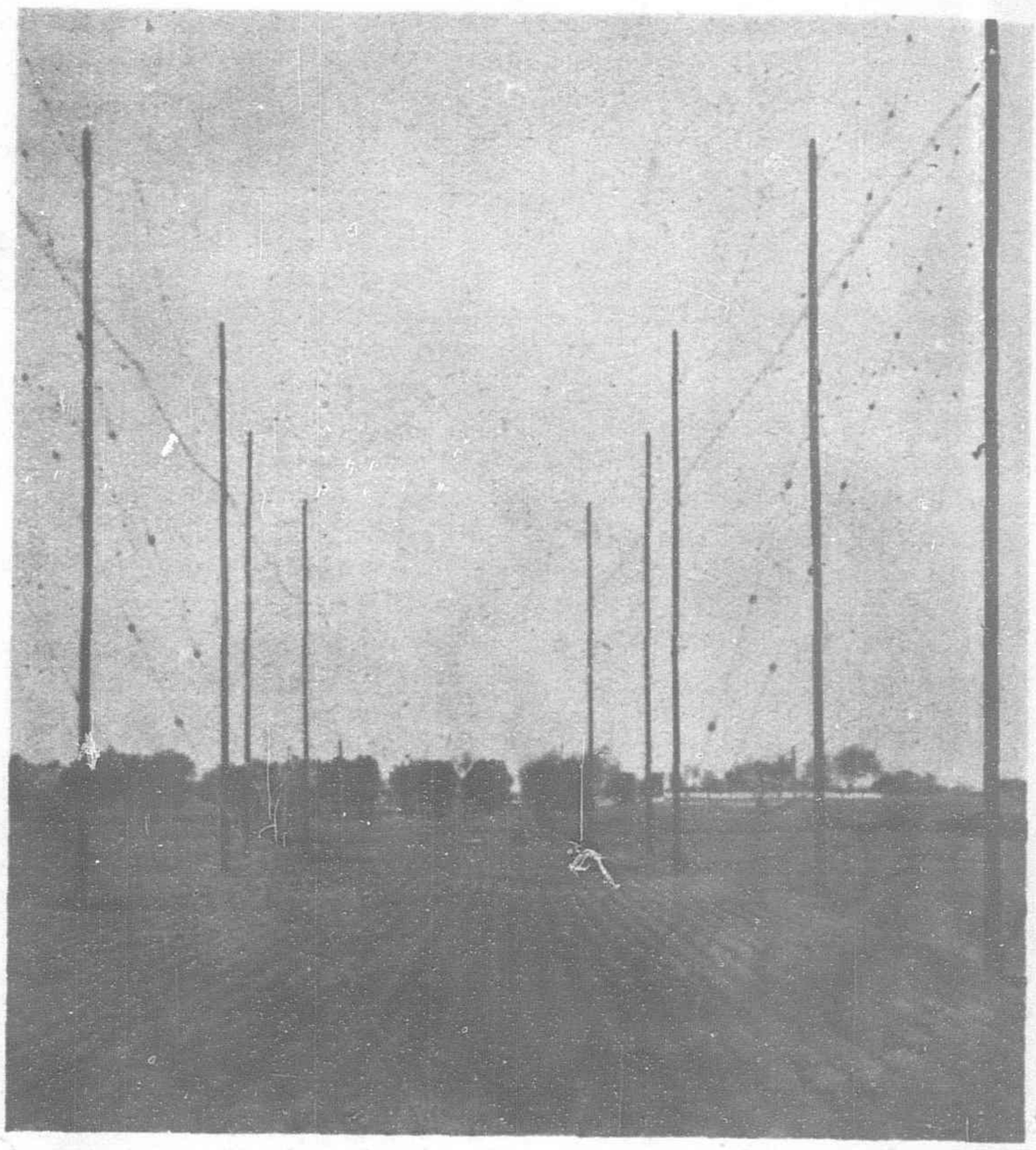
Trans-Pacific Radio in North-Eastern China

By P. W. DERBY, R.C.A., Engineer

AUGUST 1, 1931, marked the official opening of direct radio communication between Mukden and San Francisco. This was the culmination of efforts extending over several years to put such a circuit into operation. The first official messages were exchanged between Marshal Chang Hsueh-liang, vice-commander of the armed forces of the Chinese National Government and Mr. William R. Castle, Jr., the Acting American Secretary of State.

The installation of equipment for this station began a year ago under the administration of General Chu Kwong-mu, Chief of the North-Eastern Electrical Communication Administration, General Chong Ping, Chairman of the Board of Communication of the Three North-Eastern Provinces, and Mr. S. Y. Chen, Chief Engineer. The construction, preliminary testing and experimental work was under the supervision of Chinese radio engineers using Chinese workmen. Co-operating with the North-Eastern Communication Administration, as consulting engineer, the writer represented the Radio Corporation of America.

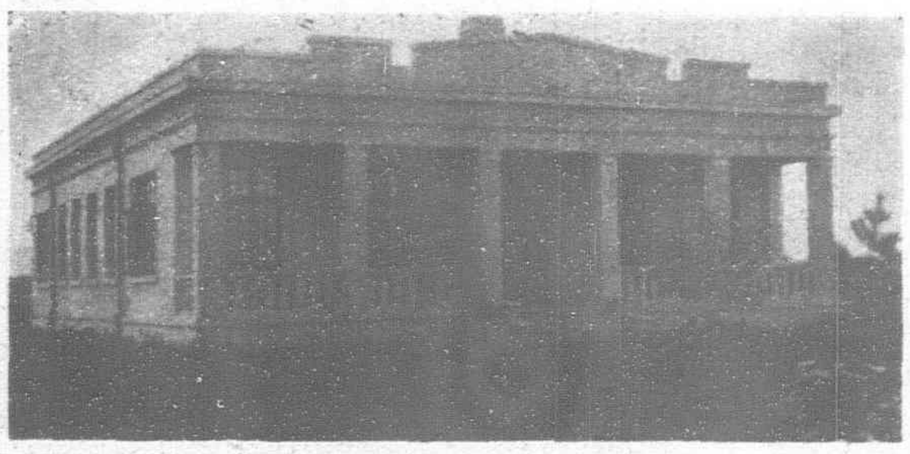
As is customary in large radio stations for handling international radiograms the Mukden layout consists of a transmitting building, a receiving building and a central office. The building housing the transmitter is located approximately four miles to the north-east of the walled city of Mukden. It houses the powerful 20/40 kilowatt equipment. This is the latest R.C.A. type and most powerful so far designed for high-frequency telegraphy. The frequency range is 6,670 to 21,500 kilocycles or 45 to 14 meters. The frequencies usually employed between Mukden and San Francisco are 19,340 kilocycles or 15.5 meters and 10,950 or 27.4 meters. The 15.5 meter wave is delivered by the transmitter to an RCA projector antenna which is directed on San Francisco. The 27.4 meter wave is delivered to a half-wave doublet antenna. The radio-frequency circuits are of the crystal controlled oscillator, intermediate power-amplifier and main power-amplifier type. The necessary high frequency output is obtained from a low frequency crystal by means of a series of frequency doublers following the crystal oscillator. All high tension voltages are obtained from rectifiers of the radiotron tube type thus eliminating the use of motor-generators.



Looking straight toward San Francisco through Directive Transmitting Antennae of the New Mukden Radio Station

At the receiving station, which is located approximately two miles to the south of Mukden, is installed two high power receivers which are fed from a directive receiving antenna bearing on San Francisco. These receivers consist of radio-frequency units, detection unit, and the audio-amplifier. The power supply is from high capacity storage batteries which in turn receive their supply from a motor-generator operating from the city power supply. The directive receiving antenna is of the Beverage short-wave type and is similar to those used in various RCA trans-oceanic services.

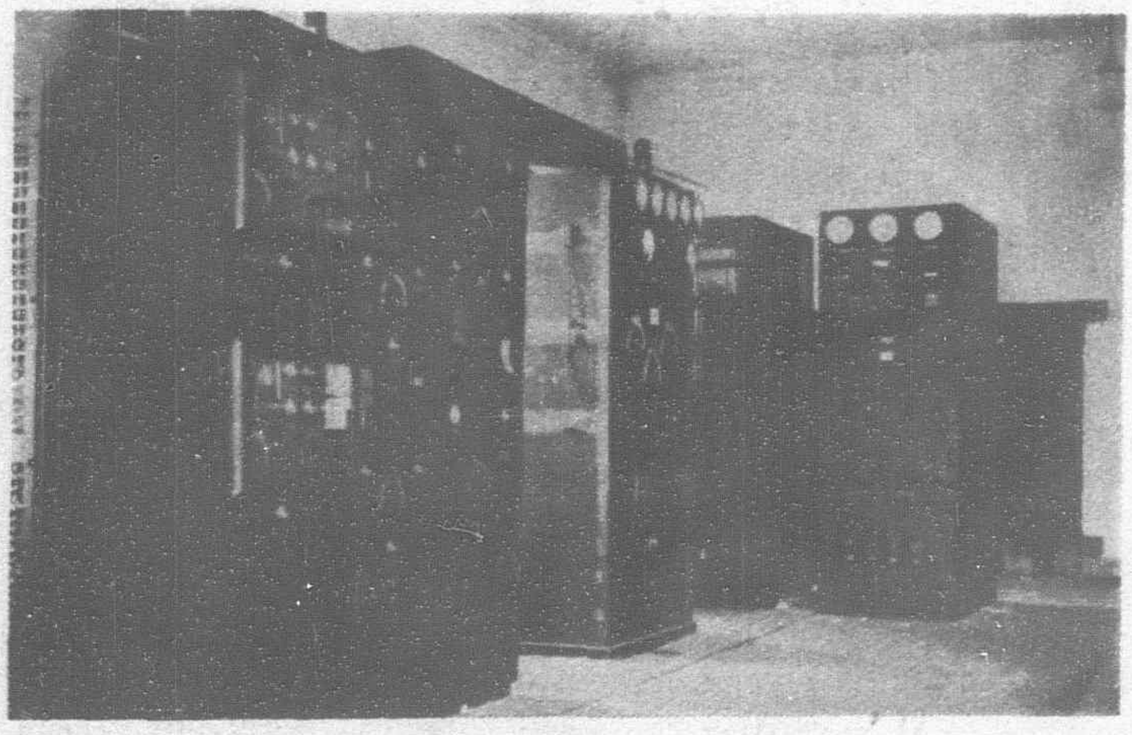
The Radio central traffic office is located in the business center of Mukden. Automatic transmitting and reception gear with the necessary auxiliary devices are installed here. The tape perforating machines for keying the transmitter and the undulators for recording incoming radiograms are operated from a storage battery supply. The receiving station and central office are connected by a 26 pair telephone cable which is used for the tone transmission. A 15 pair cable is used for key line control to the transmitting station.



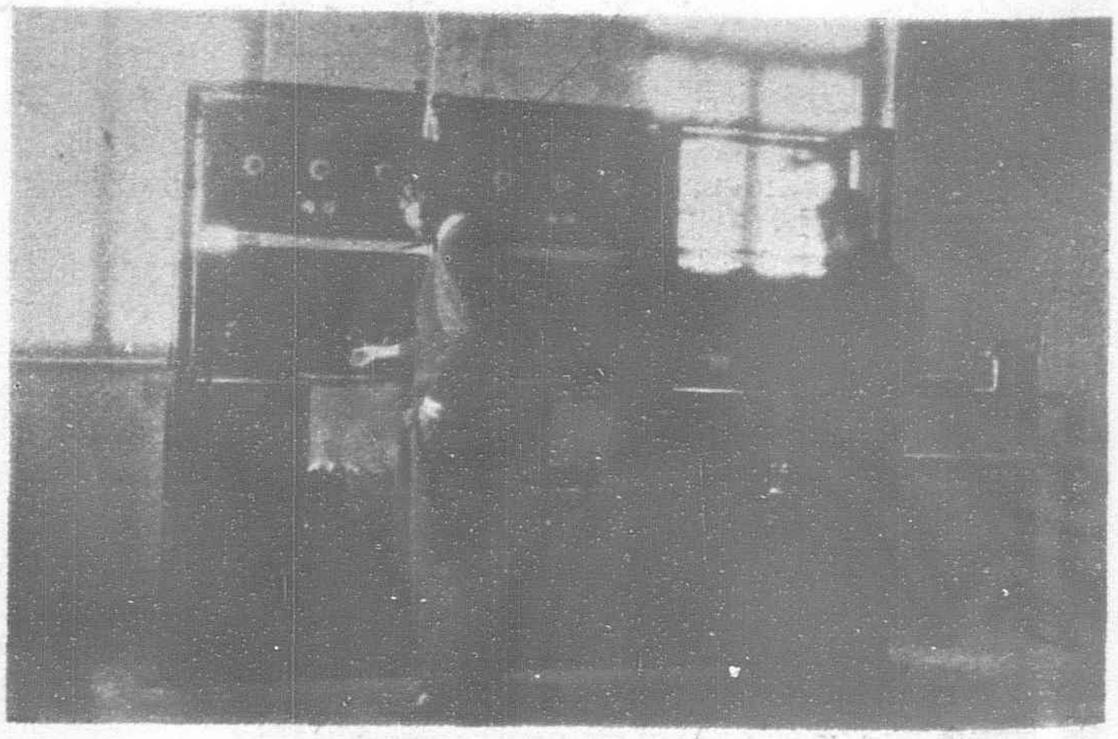
Building housing R.C.A. Trans-Pacific Transmitter

In addition to the North China-America circuit there is also direct

(*Continued on page 505.*)



R.C.A. Transmitter under construction at the Mukden Station



R.C.A. Receiver Unit at Mukden Station

"It Takes a Lockheed to Beat a Lockheed"

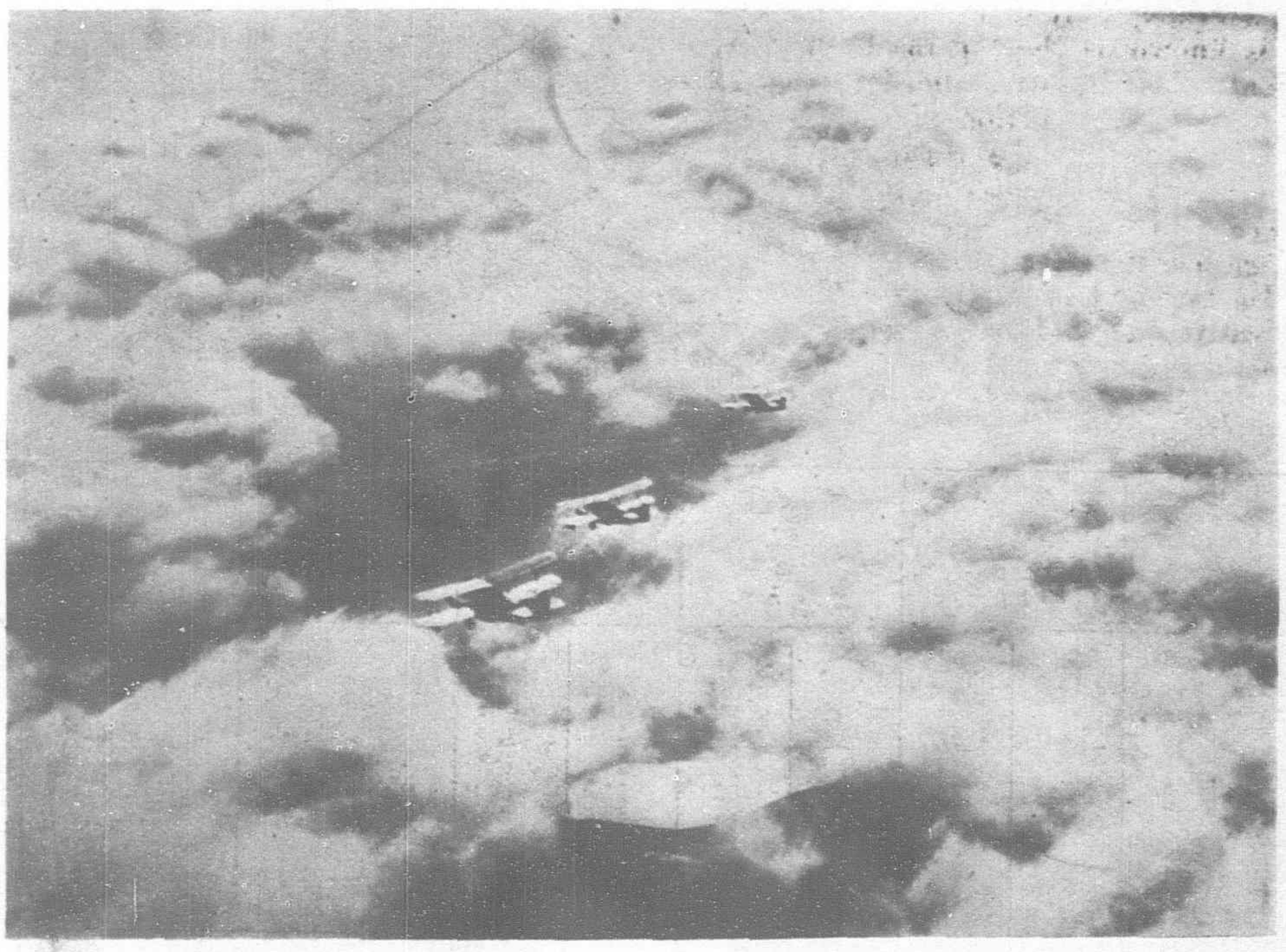
By HARRISON FORMAN

RIVALLING the wildest fancies of that inimitable visioner, Jules Verne, two Americans, Captain Wiley Post and Lieut. Harold Gatty, recently startled the world by accomplishing the phenomenal achievement of flying around the world in eight days, 15 hours and 51 seconds! Their actual flying time in their Pratt and Whitney "Wasp"-powered Lockheed "Vega" was only four days, 10 hours and eight minutes, with an average rate of speed of 145 miles per hour.

Speed—Speed—Speed! This has been the ever increasing desire and aspiration of man ever since he first took the dead-weight load from his back and placed it upon wheels. He had discovered that "pulling" was easier than "carrying." The exigencies of this driving urge could only result in a steady evolution to faster and more efficient modes of transportation, until to-day he is able to hurtle through the air at the fearful speed of six miles per minute! And it is predicted that in the forthcoming Schneider Cup Races this year this maximum may possibly be raised to seven miles per minute!

Of course, such record speeds are exceptional and necessarily impracticable with the present-day limited landing field facilities, and incompatible with imperative safety requirements. To the present year expensive multi-motored air liners with speeds around the hundred-mile-an-hour mark have been the most accepted form of dependable air transport. However, owing to the increasing confidence placed in the reliability of the modern aircraft motor, the trend for air travel has steadily shifted to the single-motored, smaller and faster ships with moderate pay-loads and increased economy of operation and upkeep.

A pioneer and leader in the field of swift, single-motored express and passenger planes is the Lockheed, (represented exclusively in China and the Orient by The L. E. Gale Company, Federal Inc., U. S. A., Shanghai). The new Lockheed "Vega" with a Pratt and Whitney 420 h.p. "Wasp" engine, N. A. C. A. Cowling and streamlined "Pants" for the wheels, carries seven people through the air comfortably and safely at the rate of more than three miles per minute. This is remarkable when one considers that it is approximately 10 per cent to 20 per cent in excess of the top speed developed by some of the best military fighting planes. Yet the Lockheed obtains this speed without the sacrifice of any of the other qualities demanded to-day of modern aircraft, such as safety, quick take-off, rapid climb, stability and maneuverability, and low landing speed.



The American aircraft squadron battle fleet, Pratt & Whitney powered, based at San Diego, flying over the Taku glacier during the recent air mapping expedition in Alaska

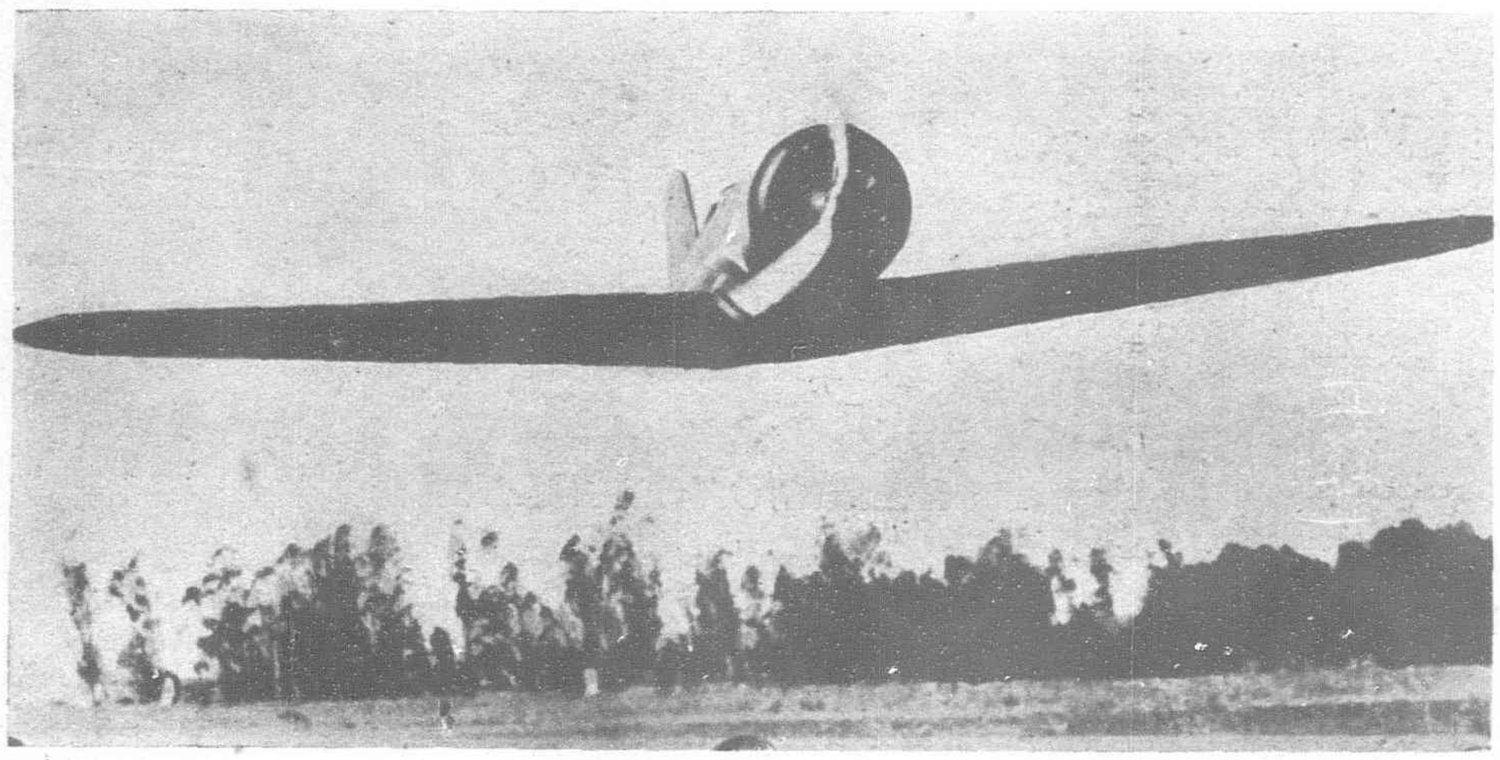
Recently, tentative schedules calling for average speeds of 150 miles per hour were announced by the Midland Air Express, Inc., of Kansas City, Missouri, which inaugurated a highspeed airline from Kansas City to Cheyenne, Wyoming. Two Lockheed seven-place "Vega" monoplanes, capable of high speeds of 180 miles per hour, make the run of 595 miles between Kansas City and Cheyenne in four hours elapsed time. Also flying Lockheed seven-place "Vegas," the New York and Western Airlines, Inc., have inaugurated on May 1, 1931, fast and frequent schedules between Pittsburgh and Buffalo, and Pittsburgh and New York, bringing New York passengers to Pittsburgh in two hours and fifteen minutes, and to Chicago in six hours. The Lockheed "Vega" planes being flown at present on this line are maintaining average speeds of 150 miles per hour. Much higher speed averages will be achieved when delivery is taken shortly of three new Lockheed "Orion" transports. The "Orion," a low-wing monoplane with retractable landing gear, will maintain the fastest schedule of any airline in the world. Carrying six passengers and baggage, it will cruise at approximately 175 miles per hour. Recently, an "Orion," piloted by Vance Breese set a record for the 355 mile run from San Francisco to Los Angeles of one hour 30 minutes and 40 seconds—averaging 236 miles per hour for the trip!

The "Orion" is a development of the standard "Sirius," which had its inception in a series of conferences between Col. Chas. A. Lindbergh and Detroit Aircraft engineers late in the summer of 1929. The specifications developed in these conferences required the incorporation of the latest features in aircraft engineering and design. It was required that safety, efficiency, maximum top speed and large carrying capacity be obtained through aerodynamic design rather than additional power. A landing speed was also desired which would permit the use of undeveloped airports far from organized airways.

Col. Lindbergh recommended an open, two-place, low-wing monoplane, of the most advanced streamline design and the Pratt and Whitney 420 h.p. "Wasp" engine for the power plant. For Col. Lindbergh's use this ship was fitted with fuel tanks of 440 gallons capacity, and is capable of making a flight of over 3,300 miles. Carrying two persons and baggage the "Sirius" has a weight empty of 2,850 pounds and will lift a gross load of 6,200 pounds and cover 175 miles per hour at full throttle. Normally, the ship will have a useful load of 2,420 pounds. As a fast mail or

express plane a cabin may be fitted with a capacity of 75 cubic feet, and a payload of 1,250 pounds, with one pilot and 150 gallons of gasoline.

A further development of the "Sirius" is the "Altair." The Lockheed "Altair," at the present time, is the fastest two-place military pursuit, observation and bombing plane built in the world. The "Altair" is simply the standard "Sirius" equipped with retractable landing gear, four machine guns, two bomb racks holding five 25-pound bombs each, a Fairchild aerial camera and radio. A military Lockheed has just passed the rigid tests given by the U. S. Air Force, and bids fair to soon becoming a standard fighting ship for the American Aerial Forces.



Lockheed "Altair" held to be the fastest and finest fighting ship in the world. Equipped with four machine-guns, two bomb racks (each holding five 25-lbs. bombs), pilot and gunner, will attain a speed of 220 miles per hour. P. & W. supercharged "Wasp" 450 h.p. engine.)

The Lockheed "Air Express" is another model of the famous family of "The World's Fastest Airplanes." The "Air Express" is similar to the "Vega" model in general design, except that the controls are located in an open cockpit aft of the cabin. In addition to this the wing is what is known as the "parasol type," being clear of the fuselage and attached by streamlined tubing. This construction permits an even greater portion of the fuselage to be used for passengers, mail or cargo, and the parasol wing gives a somewhat greater lift due to the clear center section.

Lockheed's speed success lies in its patented design. The famous monocoque fuselage construction provides the greatest possible strength for the least weight of dead material, and consequently, larger payload with added safety. Secondly, the form of the fuselage and its smooth surface provide the most practicable streamline shape, requiring the least power for propulsion through the air. Thirdly, this form of construction provides an unobstructed interior, free from structural bracing and permitting the maximum of cargo capacity or passenger comfort. Lockheeds may be had with all-wood, all-metal or wood and metal construction.

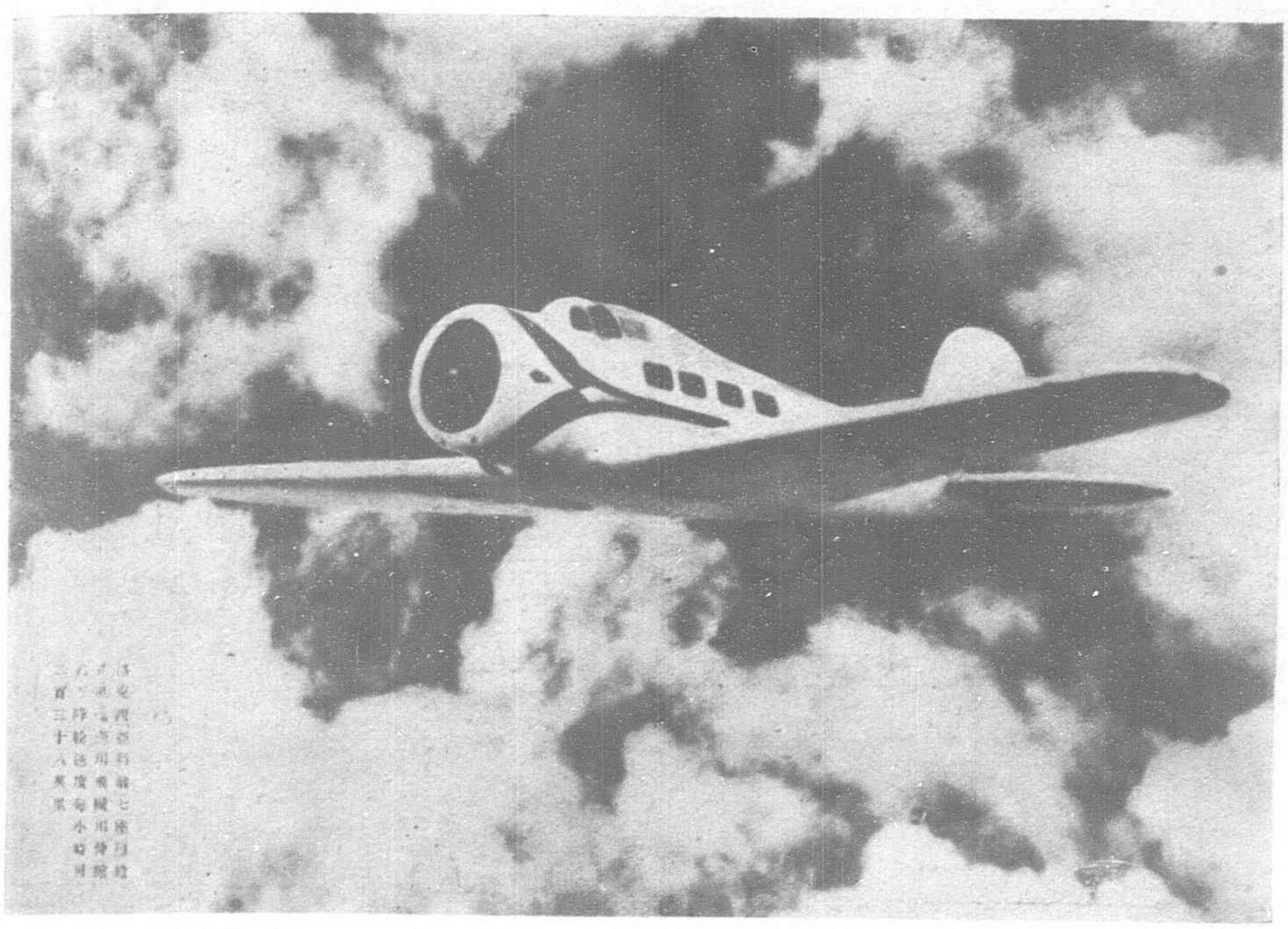
The Lockheed Hall of Fame holds an enviable gallery of records. The name is symbolical of the utmost in speed to airman and schoolboy alike. Back and forth across the American continent, dashing from capital to capital of the countries of Europe, over the top of the world and around it at break-neck speed the name of Lockheed has flashed. The slogan "It takes a Lockheed to beat a Lockheed" has come to be an accepted fact. Captain Frank Hawks, not content with shattering trans-continental speed records in America, took his Lockheed to Europe where he gave wonderful demonstrations of speed flying from capital to capital. Another Lockheed was used by Commander Kidston on his record-breaking flight from London to Cape Town. The world is still paying homage to those two courageous Americans, Post and Gatty, who scuttled around the world in a little better than eight and one-half days. The sturdiness of the Lockheed construction was amply proved by Captain Sir Hubert Wilkins' Lockheed "Vega," in which he flew over the North Pole, and which was accidentally dropped into the sea during the process of unloading from the steamer to the land. Although the plane sank and remained immersed for several hours, when it was recovered it was simply dried out, and is still in service to-day.

A summary of the specifications and performance data of the several Lockheed models will reveal some astonishing figures:

Power	*Vega— 5 Pl. Wasp— 420 h.p.*		*Vega— 7 Pl. Wasp— 420 h.p.*		*Air Exp.— 5 Pl. Wasp— 420 h.p.*		*Sirius— 2 Pl. Wasp 420 h.p.*	*Jupiter— 12 Pl. Cyclone— 575 h.p.*	*Altair—2 Pl. Wasp Supercharged 450 h.p.*	*Orion— 7 Pl. Wasp 420 h.p.*
A. T. C. No.	93	93	227	227	102	Pending	378	Pending	Pending	Pending
PERFORMANCE (full load)	Landplane	Seaplane	Landplane	Seaplane	Landplane	Seaplane	Landplane Retractable Gear.	Landplane	Landplane Retractable Gear.	Landplane Retractable Gear.
High Speed—m.p.h.	165	157	165	157	161	153	—	158	—	—
With N. A. C. A. Cowling	180	172	180	172	176	168	200	—	220	204
Cruising Speed	140	132	140	132	136	128	—	135	—	—
With N. A. C. A. Cowling	155	147	155	147	151	143	160	—	190	171
Landing Speed	55	58	58	60	55	55	60	60	61	60
Cruising Range	700	660	700	660	680	640	—	440	—	—
With N. A. C. A. Cowling	775	735	775	735	756	—	850	—	—	—
Service Ceiling	22,000	18,500	20,000	17,500	20,000	18,000	17,000	14,600	1,000	—
Rate of Climb (S. L.)	1,500	1,000	1,200	1,000	1,500	1,000	1,100	860	1,900	—
WEIGHTS AND LOADS	Lbs. Gas 100; Oil 10		Lbs. Gas 67½; Oil 8 Capacity 100,10		Lbs. Gas 100; Oil 8		Lbs. Gas 136; Oil 1:	Lbs. Gas 107; Oil 1/	Lbs. Gas 190; Oil 10	—
Gas	600	600	405	405	600	600	816	—	—	—
Oil	75	75	60	66	60	75	90	—	—	—
Pilot	170	170	170	170	170	170	200	—	—	—
	845	845	635	635	830	845	Pass. 200	—	—	—
Payload	696	876	1,140	1,190	1,012	920	936	3,120	—	—
Useful Load	1,541	1,721	1,775	1,825	1,842	1,765	2,242	4,040	1,530	—
Weight Empty	2,492	2,977	2,490	2,925	2,533	3,235	3,008	4,255	3,000	—
Gross Weight	4,033	4,698	4,265	4,750	4,375	5,000	5,250	8,295	4,530	—
Wing Area	275 sq. ft.		275 sq. ft.		288 sq. ft.		275 sq. ft.	550 sq. ft.	275 sq. ft.	—
Wing Loading	15.75	17.18	15.51	17.27	15.20	17.37	19.1	15.1	16.45	—
Power Loading	9.60	11.19	10.17	11.30	10.42	11.90	12.5	14.4	9.06	—
DIMENSIONS										
Span—overall	41′0″		41′0″		42′6″		42′10″	60′	—	—
Length—overall	27′6″		27′6″		27′6″		—	—	—	—
Height	8′4½″		8′4½″		8′4½″		—	—	—	—
Wheel Tread	8′		8′		8′		—	—	—	—

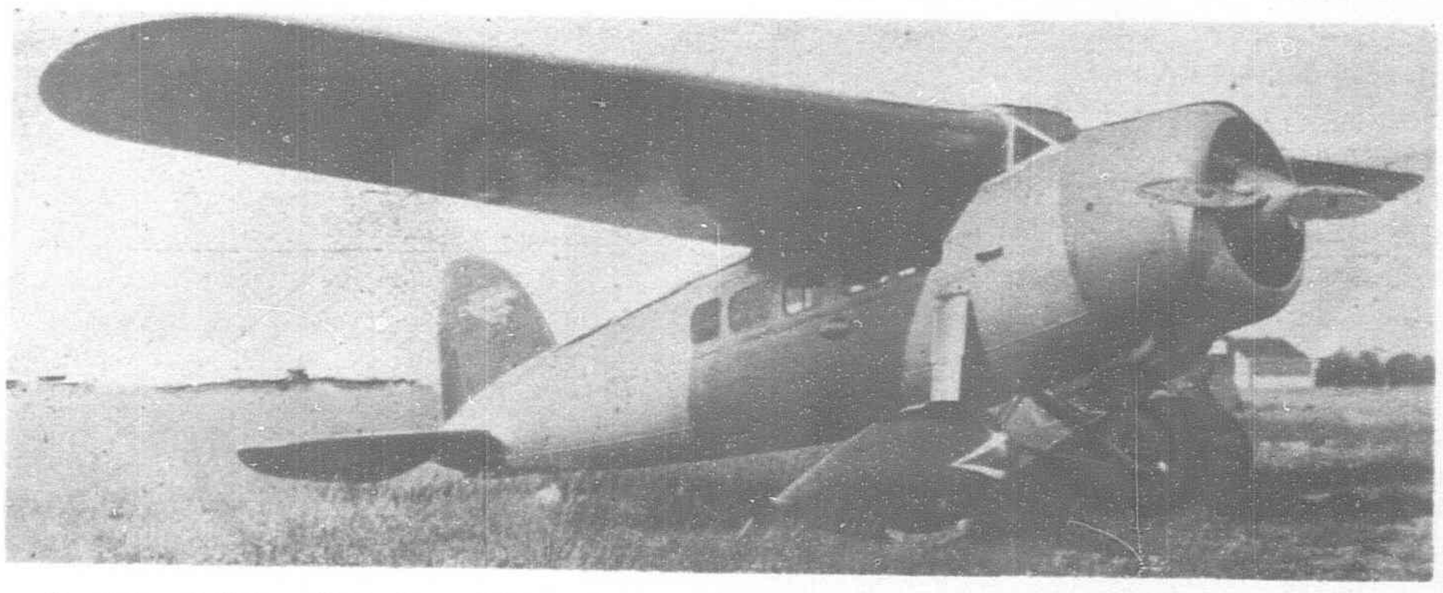
All figures guaranteed to within plus or minus 5%

With N. A. C. A. Cowling and wheel fairings, the cruising speed of the Lockheed Vega 7 pl. Landplane is increased to 160 m.p.h. and the top speed to 185 m.p.h.



Lockheed "Orion" seven-place high-speed transport in flight. Retractable landing gear drawn up into the wings to reduce resistance. Capable of a high speed of 236 miles per hour. (P. & W. "Wasp" 420 h.p. engine.)

The Lockheed people have worked out a table of operating costs compiled from operation statistics of Lockheed owners extending over a period of several years which represents only a very conservative average. This information in comparison to that of an average tri-motored transport now in general use, is enlightening in consideration of the present trend toward the smaller and faster single motored craft for aerial transportation. A 40 per cent yearly depreciation on the ship and an engine life of only 2,000 hours will be considered extremely modest by most operators. The figures in the table are based upon a cruising speed of 140 miles per hour (without the N. A. C. A. Cowling) and a payload of six passengers or 1,240 pounds. (All dollar signs refer to U. S. Gold Dollars.)



Lockheed "Vega" 7-place high wing cabin monoplane Pratt & Whitney "Wasp powered"

INDIRECT OPERATING COST

	Per Year	*per Hr. on Basis, 590 hrs. per yr.*
Ship depreciation (40 per cent ship less engine)	$4,680	
Pilot's salary	3,000	
Annual overhaul of ship ..	500	
Pilot's insurance	130	
Ship and engine ins.—fire, tornado, crash, etc. @ 20 per cent value	3,780	
6 per cent int. on investment, ship and engine	1,134	
Hangar rent	300	
TOTAL INDIRECT COST ..	$13,524	
		$27,048

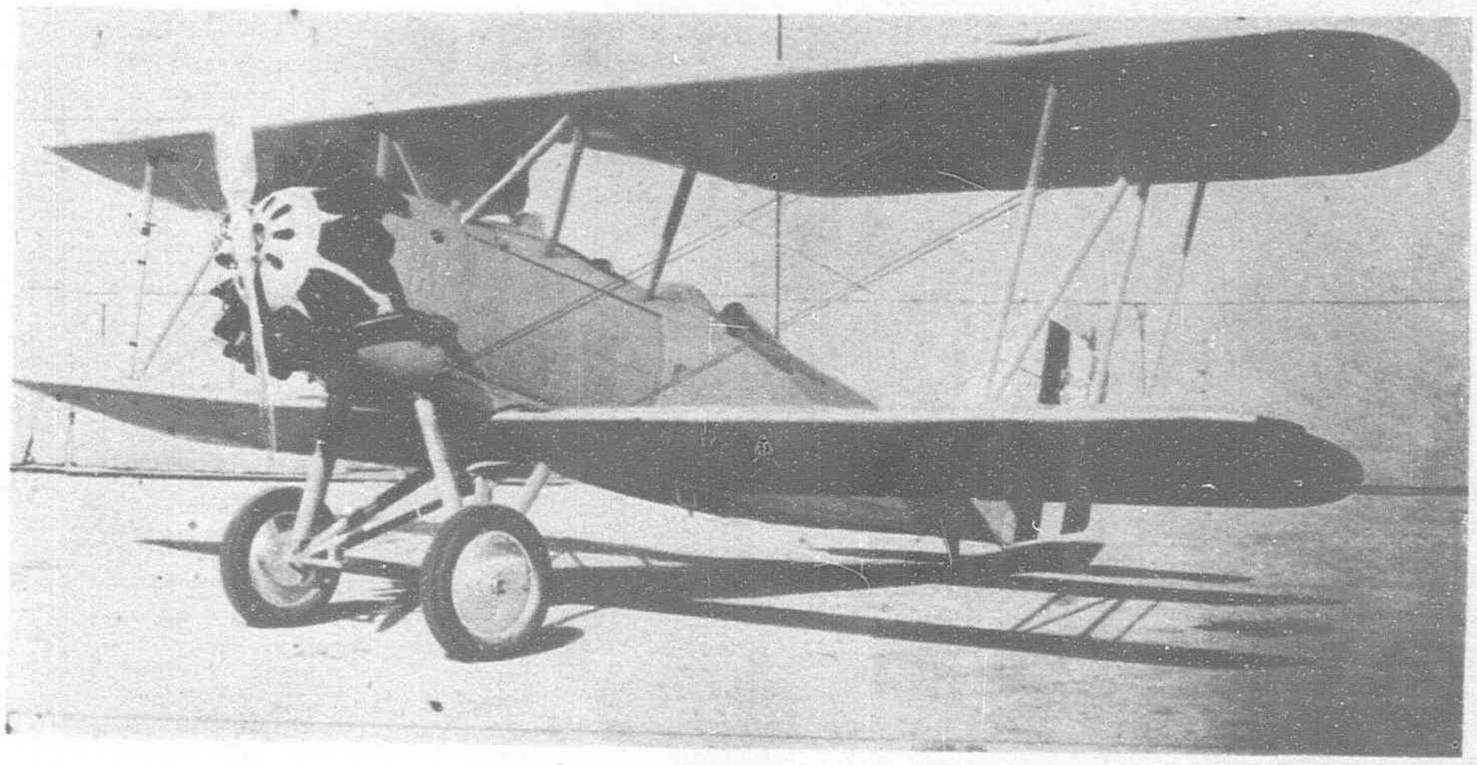
DIRECT OPERATING COSTS.

	Per Hour.
Engine depreciation (200 hr. basis)	$3.60
Oil and gasoline	5.29
Engine overhauls—one every 300 hrs. @ $300	1.00
Pilot hourly bonus	2.00
TOTAL DIRECT COST	$11.80
	$11.80
TOTAL COSTS—DIRECT AND INDIRECT	$38.848/hour
Cost per mile @ 140 m.p.h. cruising speed	27.74 cents
Cost per mile @ 155 m.p.h. with N. A. C. A. Cowling ..	25.06 cents
Cost per passenger mile ..	4.62 cents
Cost per pound mile	0.02 cents

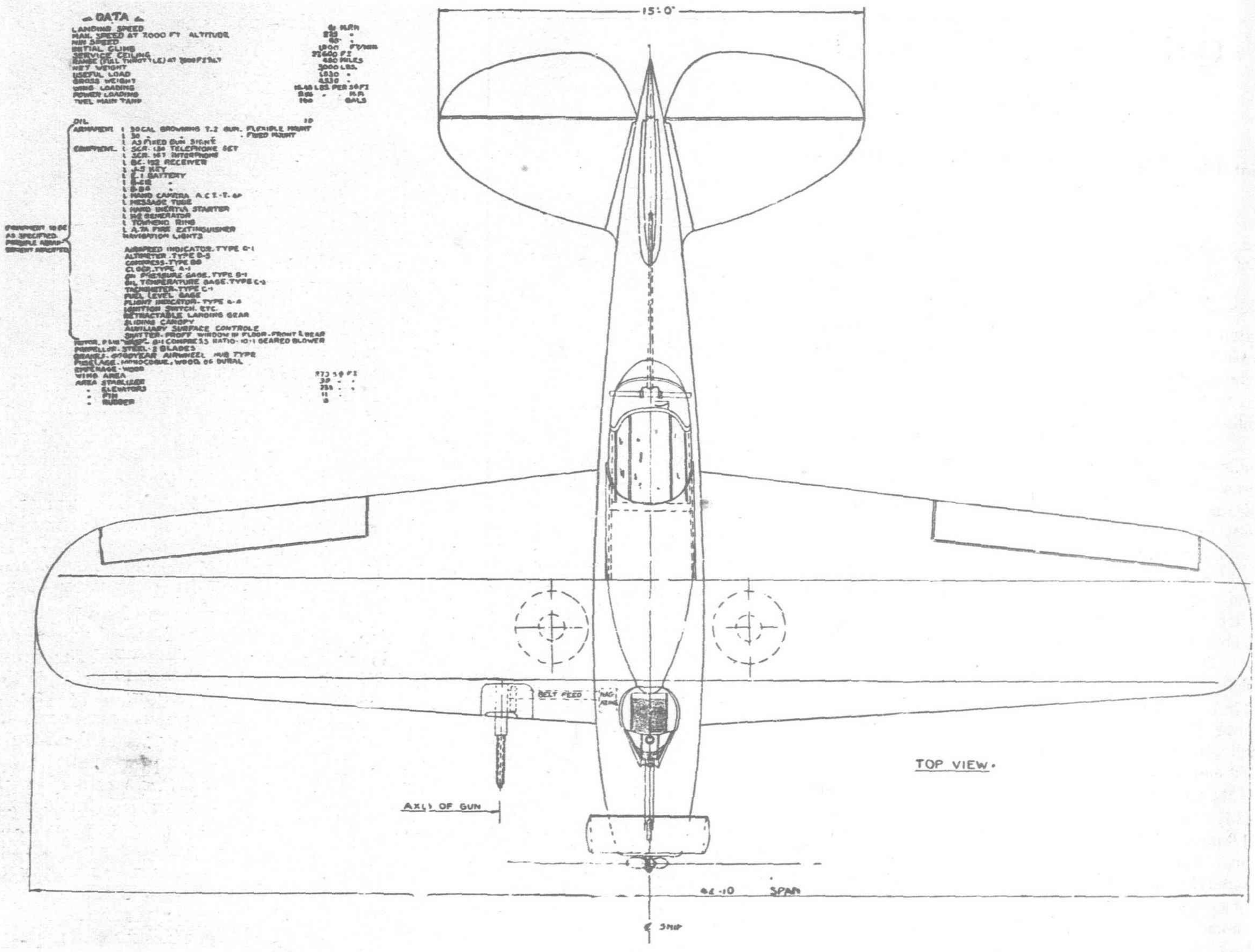
A similar table worked out for a typical tri-motored plane with a cruising speed of 105 miles per hour, as against the 140 m.p.h. cruising speed of the Lockheed "Vega," reveals the significant figure of 8.2 cents per passenger mile —about 80 per cent higher. Since speed and economy are two of the prime factors of transportation, it is no wonder that operators are turning steadily to ships of the Lockheed class.

No mention made of an aircraft is complete without a word about the power plant. The engine is the integral part of airplane construction. Upon the motor's continued dependability and efficiency rests the entire success of an airplane's reputation. Internationally famous where dependable flying power is demanded for every operating condition in both military and commercial service, is the Pratt and Whitney Aircraft Company, (a division of United Aircraft and Transport Corporation), manufacturers of the "Wasp" and "Hornet" air-cooled radical aeronautical engines. In China, at the present time, there are about 60 Pratt and Whitney engines in operation. Thirty-four "Wasps" are installed in the 34 Vought "Corsair" fighting ships sold to the Chinese National Government by The L. E. Gale Company, Federal Inc., U.S.A., of Shanghai, who are exclusive representatives in the Orient for the complete line of Pratt and Whitney Aircraft engines.

The 420 horse-power " Wasp " is the standard power plant for the entire Lockheed line of speed ships. The " Wasp " has flown millions of miles in the grilling service of the United States Air

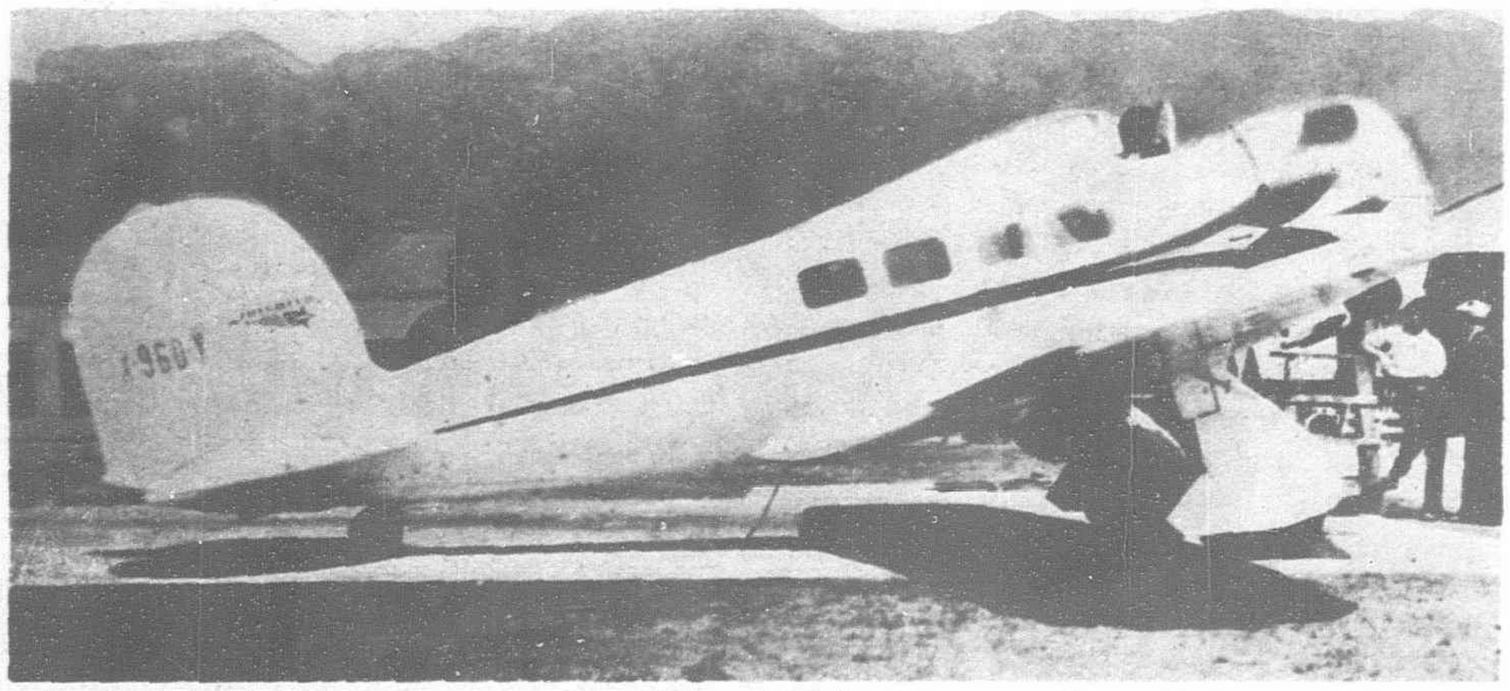


One of the 34 Vought "Corsairs" sold to the Chinese National Government. Equipped with a Pratt & Whitney 420 h.p. engine.



Forces, and in addition has earned an enviable reputation while in use extensively—in many cases exclusively—on the important air transport lines both in the United States and in foreign countries.

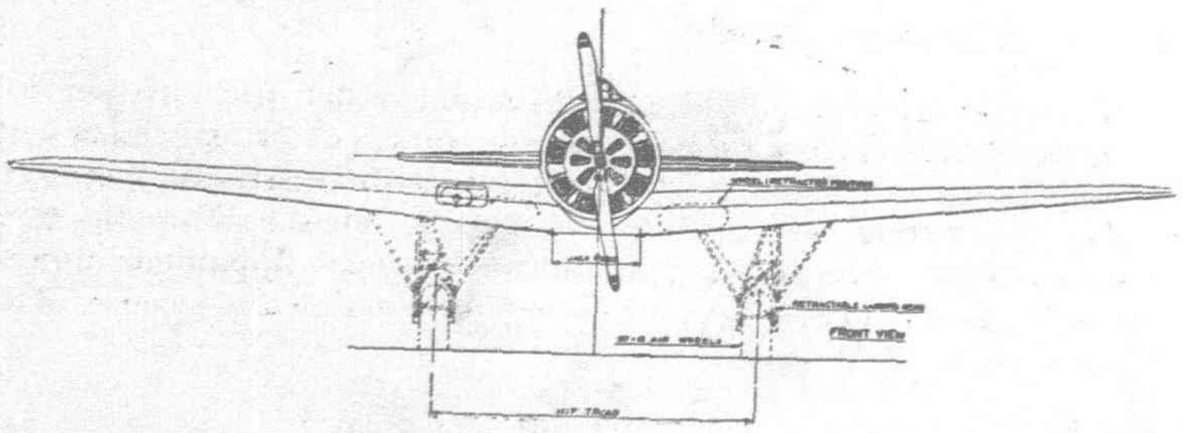
The "Wasp" hold the enviable record of being the only aircraft engine to have flown over both the Earth's Poles—having been used by Captain Wilkins in his Lockheed "Vega" at the North Pole and by Commander Byrd in his tri-motored Ford on his dash to the South Pole. It also shares honors with the Lockheed "Vega" for the world-encircling record of a little better than eight and one-half days recently hung up by those two daring Americans, Captain Post and Lieut. Gatty.

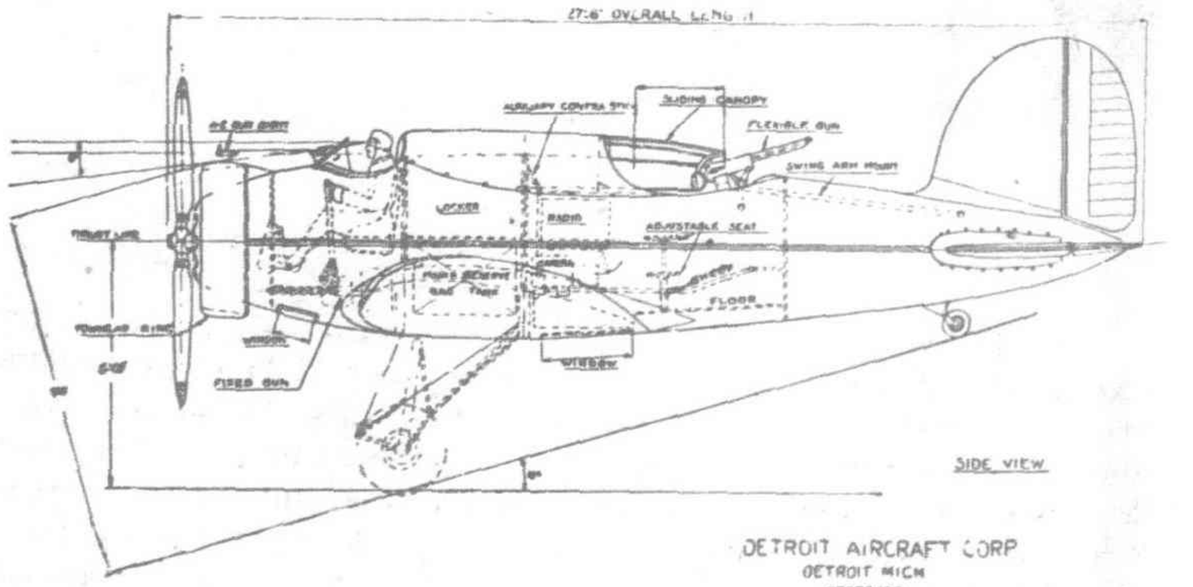


Lockheed "Orion" at rest. A sliding hatch fits over the pilot's cockpit to protect him from the elements

A table of operations costs for the Pratt and Whitney "Wasp" based on 265,000 flying hours with eighty different "Wasp" engines operated by five different fleet operators, has recently been compiled. The figures do not represent the total number of hours flown during the past

(Continued on page 503).





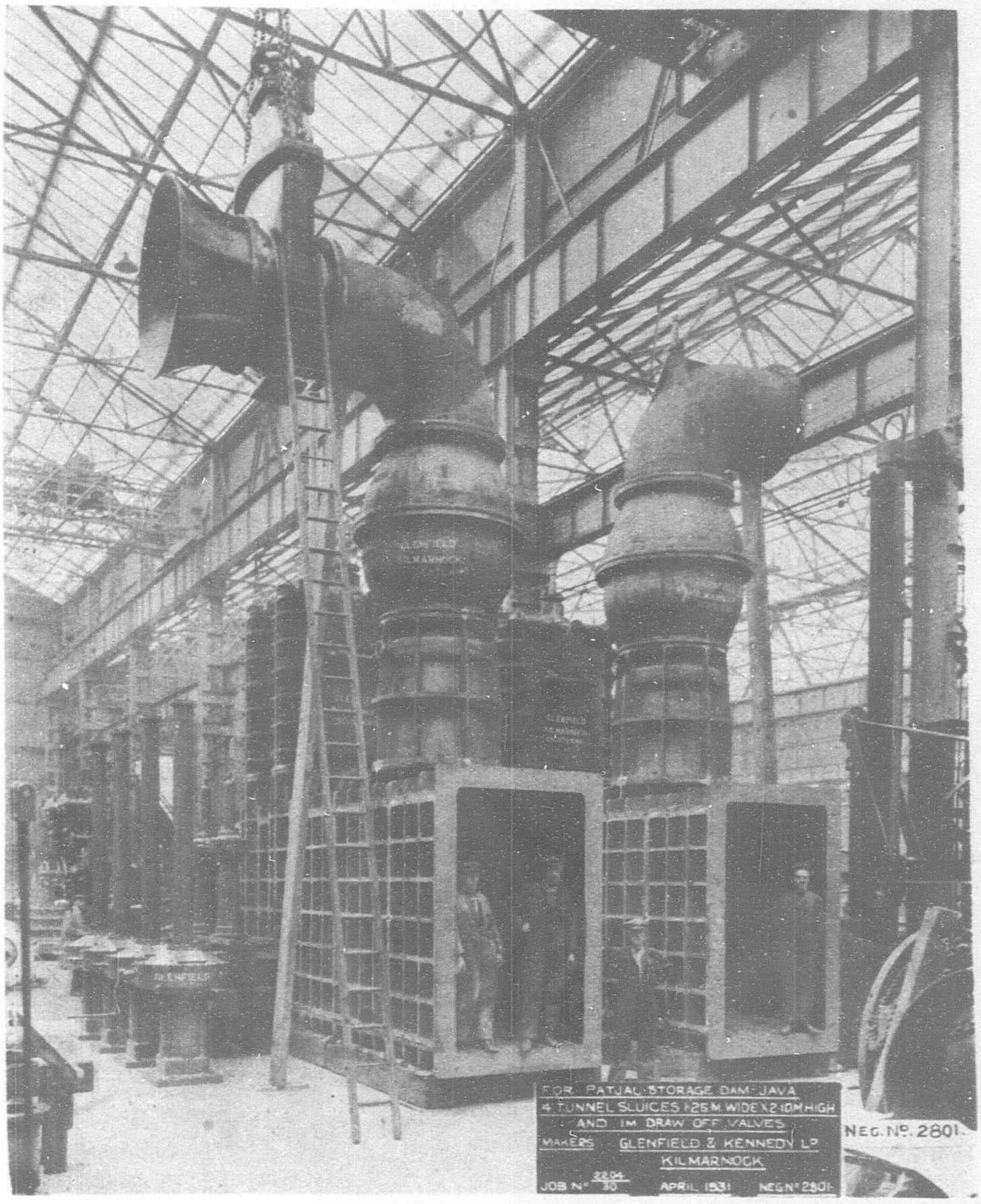
Patjal Storage Dam in Java

Notable Installation of Tunnel Sluices and Valves

THERE is now under construction in Java by the Government of the Dutch East Indies an important reservoir scheme, known as the Patjal, involving the erection of an extensive dam possessing a number of interesting features, particularly in connection with the arrangement of the control and regulating valves because of the large amount of silt that will collect, due to the local conditions.

In this connection we are able to give some information, together with photographs, of the draw-off equipment that has been supplied by Messrs. Glenfield & Kennedy, Ltd. of Kilmarnock, Scotland, and which has been tested exhaustively by inspectors of the Dutch Government, with results that have much exceeded their requirements and expectations, both during manufacture and after complete erection in the engineering shops at Kilmarnock.

The complete contract included four tunnel sluices 1.25 meters by 2.10 meters (4.1½-in. by 7-ft. 0-in.), designed to withstand and operate under a head of water of 33 meters (108 feet) above the sill with no back-pressure ; two needle valves each 1.0 meter (3-ft. 3-in.) inlet, with " Venturi " throat 0.914 meters (3-ft. 0-in.) opening out to 1.0 meters (3-ft. 3-in.) ; and two double flanged sluice valves 1.0 meter (3-ft. 3-in.) with bellmouth inlet pieces, and 4-in. by-pass valves and bends, operated through suitable gearing, along with a large amount of accessory equipment, including connecting pipes, tunnel linings, complete operating headstocks, and air supply pipes.



Patjal Storage Dam in Java

The two sets of regulating valves, that is one needle valve and one double flanged sluice valve in each set, are to be housed near the bottom of a reinforced concrete valve tower 117-ft 0-in. high, situated in the storage reservoir, the tunnel linings and sluice bodies being completely built into the concrete but the sluice domes and needle and sluice valves left exposed within the tower. The operation is carried out by means of rods for each of the sluices, and valves, carried up inside the tower, and operated by worm geared headstocks situated at the top. Also the normal draw-off from the reservoir is through the two circular bellmouth entrances built into the tower walls, which are 18-ft. 0-in. above the floor of the reservoir, with discharge vertically downwards into the rectangular culverts.

The amount of water passing is regulated by the needle valves, for which the sluice valves, normally in the full open position, act as guards for use in the event of dismantling of the needle valves. Also the invert level of the sluices is located approximately on the floor of the reservoir, their purpose being to act as scour control valves for eliminating accumulations of silt, these sluices, as indicated, being grouped in pairs, of which the down-stream unit acts as the normal operating sluice, with the up-stream unit as the guard. For this purpose the doors are of special design, being constructed of solid armor plate with perfectly smooth sides, to allow of easy passage through the silt, provided also with large section bronze seats corresponding to similar seats in the bodies, recessed and pinned in position. Also the operating rods for these tunnel sluice doors are of forged bronze, provided with coned collars to allow repacking the glands under pressure, the whole arrangement of the sluices and their operating headstocks being rigidly connected by mild steel tie rods, extending the full height of the valve tower.

The needle valves follow the normal standard " Glenfield " design with easily renewable seats and all bearings and working surfaces lined with gunmetal, while special precautions have been taken to avoid the effects of cavitation, the discharge side of the valves being well ventilated through 6-in. diameter steel tubing extending to within 5-ft. 0-in. of the top of the valve tower.

The headstocks also follow the firm's standard design, having totally enclosed machine cut worm gearing working in an oil bath, while the sluice headstocks have an auxiliary set of high-powered spur gearing for the initial opening of the valves, constituting altogether a fine example of modern engineering in this particular field.

Japan and China Imports Siberian Kedar

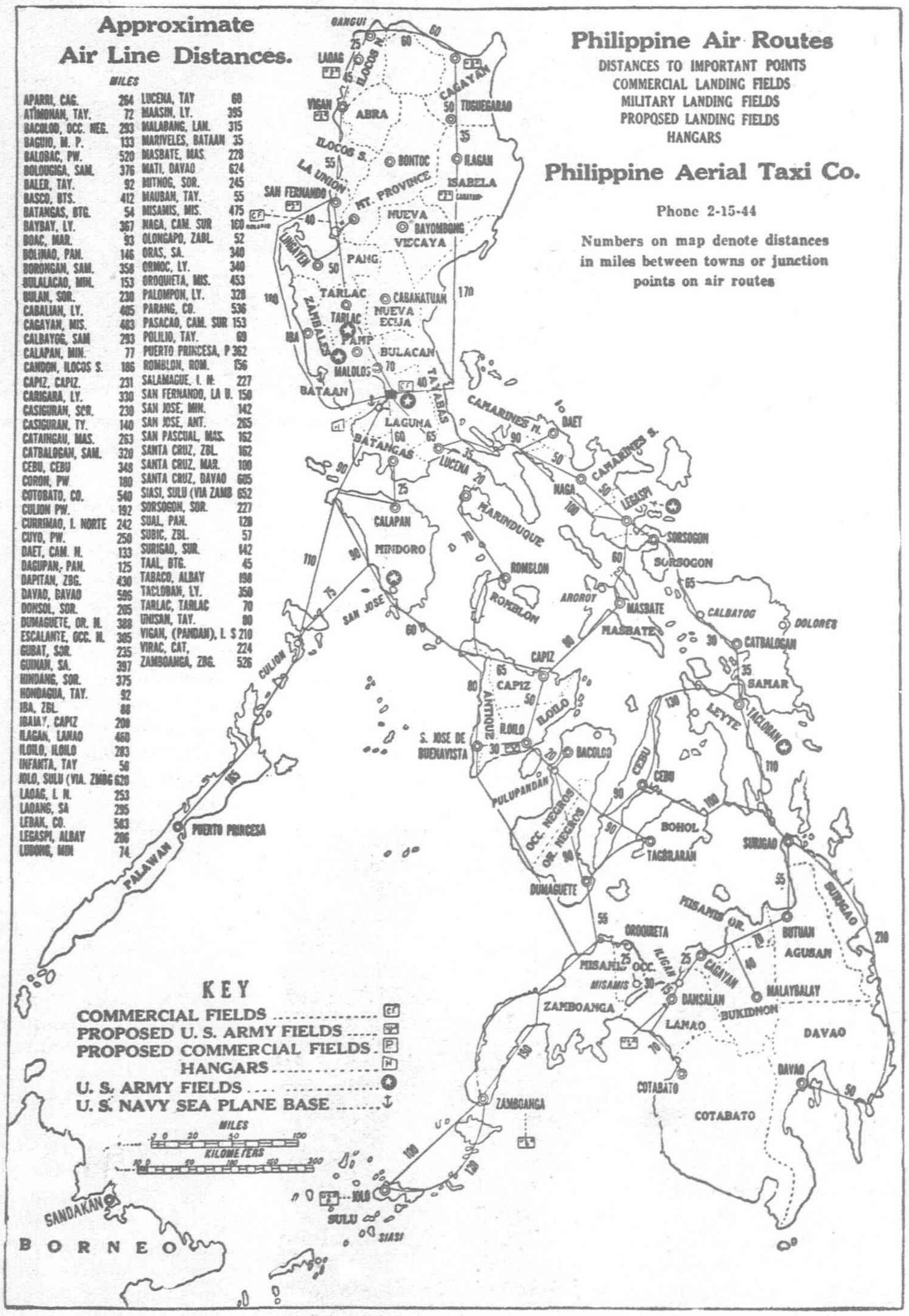
Importations of Siberian kedar logs into Japan for 1930 aggregated 120,000,000 feet, an increase over 1929 of 60,000,000 feet. The 1931 import promises to be less. The Mitsubishi Company, it is reported, has not come to a complete understanding with the Soviet government regarding the annual maximum import of logs from Siberia, which was calculated to approximate 200,000,000 feet annually, covering a period of years. It is understood the Soviet government desires to advance the price 10 per cent, which Mitsubishi Company does not approve. It is reported the China Import & Export Co., Shanghai, contemplates importing this year 20,000,000 feet of Siberian logs purchased from the Soviet government. During the past four or five years Japan has imported from Siberia an average of 240,000,000 feet of all species of logs annually.

Air Taxies in the Philippines

THE realization of commercial aviation in the Philippine Islands, now being rapidly developed by the Philippine Aerial Taxi Company of Manila, is the result of a chance conversation between Mr. E. M. Bachrach, President of the Bachrach Motor Co., P.I. distributors for White commercial vehicles, Nash, DeVaux, Durant and Stutz cars, Chris-Craft speed boats, marine motors and general supplies, and Mr. J. E. H. Stevenot, Manager of the Philippine Long Distance Telephone Co. This discussion took place in the latter part of 1930 and immediate action was taken toward the organization of a company.

A group of representative citizens, international in its scope, was solicited for subscriptions to a project that was largely civic as no immediate or near immediate returns could be expected on the money invested. The history of air transport companies in the United States and Europe furnished plenty of testimony as to the length of time necessary to develop a profitable business even where mail subsidies were available and a reasonable amount of freight and express matter was assured. Nor was there an air-minded public in the Philippines anxious to climb aboard the planes as soon as they were put in service.

The first plane, a Waco, arrived early in February. Through the courtesy of the U.S. Army Air Corps the local company had been able to secure the use of Nichols Field, just outside of Manila, for setting up and testing their first planes. They were also fortunate in securing the services of one of the army aviators, Lt. Backes, who was going on leave for two months and who accepted a temporary position with the company for that period. They were thus assured of the maximum efficiency in their initial efforts to get things under way.



"Doug" Goes Up

Next came a goodly portion of publicity in the arrival in Manila of Douglas Fairbanks, the famous moving picture star, and his cheerful consent to inaugurate the service by going up in the Waco on its first flight with anyone other than its test pilots and officials of the company. This event took place at Nichols Field on February 21, attended by a large and enthusiastic gathering who came to see the Philippines' first commercial airplane as well as the popular "Doug."

Lt. Backes acted as pilot on this initial flight and he and his distinguished passenger were accompanied by Miss Peggy Steele, daughter of James King Steele, Executive Secretary of the Philippine Tourist Association. At the conclusion of the flight Mr. Fairbanks presented Mr. E. M. Bachrach with an autographed one peso Philippine bill as the first "fare" paid to the new company.

Immediately following this event came the news of the expected flight of the late Glenn Warren Brophy from China to Manila and elaborate preparations were made by the Aerial Taxi Company for his reception. Hundreds of invitations to the expected landing at Nichols Field were issued, as well as cards for a buffet lunch at the Manila Hotel. The unfortunate ending of Mr. Brophy's attempt to fly the China sea is well known yet neither it nor the loss of Mr. F. A. Deikhoff and his passenger off the coast of Davao seemed to put any damper on local aviation enthusiasm and it was generally conceded that in neither case were the men properly equipped to attempt their respective flights.

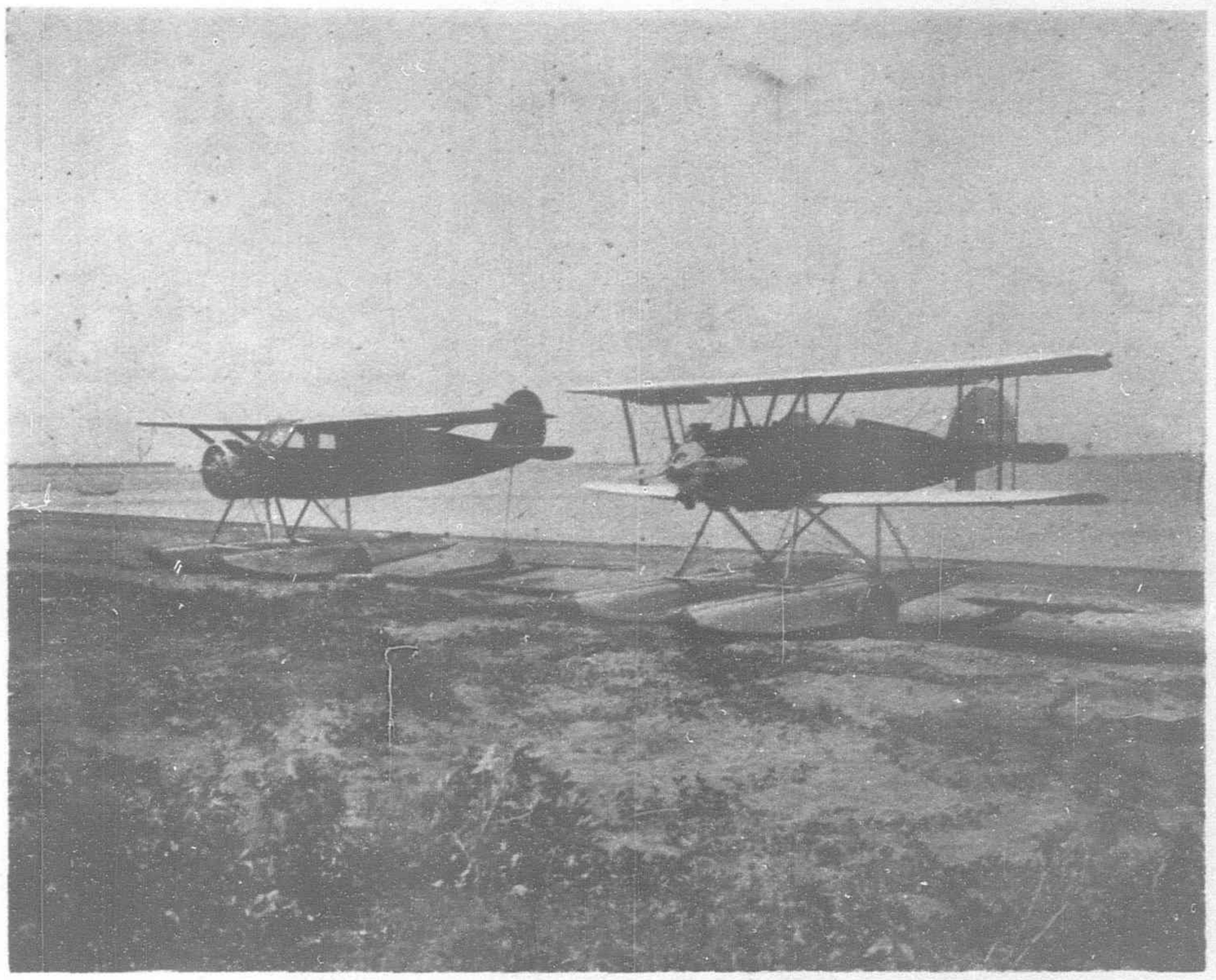
Mr. Deikhoff was an "old timer" in the Philippines, representing the Simmons Saw Co., and on his last trip arrived with a Stinson cabin plane with the intention of using it during his work of covering the Philippines for his firm. He had made several flights over Manila and nearby points without trouble and one of his spectacular performances was a landing on the new Wack-Wack golf course on the day of its opening. He was accompanied by Mr. E. M. Bachrach. Both the landing and the take off were made in perfect form.

Another Event

Another epoch-making event on the February calendar was a flight from Manila to Baguio and back before lunch by Lt. Backes,

pilot, with Mr. E. M. Bachrach and Mr. J. E. H. Stevenot as passengers. The party left Manila in the Waco plane about seven a.m. and landed in Baguio on the polo field one hour and a half later. Aside from a short period of Arctic temperature at an altitude of some 9,000 feet while approaching Baguio the passengers reported solid comfort and a gorgeous scenic panorama worthy of world-wide advertising. After a thoroughly-enjoyed breakfast of double and triple portions and a short interview with Baguio city officials regarding future landing field sites the party took off for Manila, arriving there at 11.30—one hour and forty minutes for the return trip. This was not the first landing of an airplane in Baguio, but the ease of the trip and the possibilities of bringing the popular resort within such a commuting range of Manila had never been so clearly demonstrated. The probable future of this much needed service will be taken up later on in this article.

During these first few weeks of activities the eyes of the government were perforce focused on the future of aviation in the Philippines and the Governor-General, on or about February 24, appointed the following committee to go into the matter of landing fields : Messrs. Jose V. Bagtas, Under Secretary of Commerce and Communications, Chairman ; Major H. W. Harms, then Commander at Nichols Field ; Directors of Lands Hidalgo, Messrs. J. E. H. Stevenot, E. M. Bachrach and Frederick Stevens of the Pacific Commercial Co. This committee handed in its report in the early part of June in which it recommended various sites for fields, the adoption of suitable regulations, and made various recommendations.

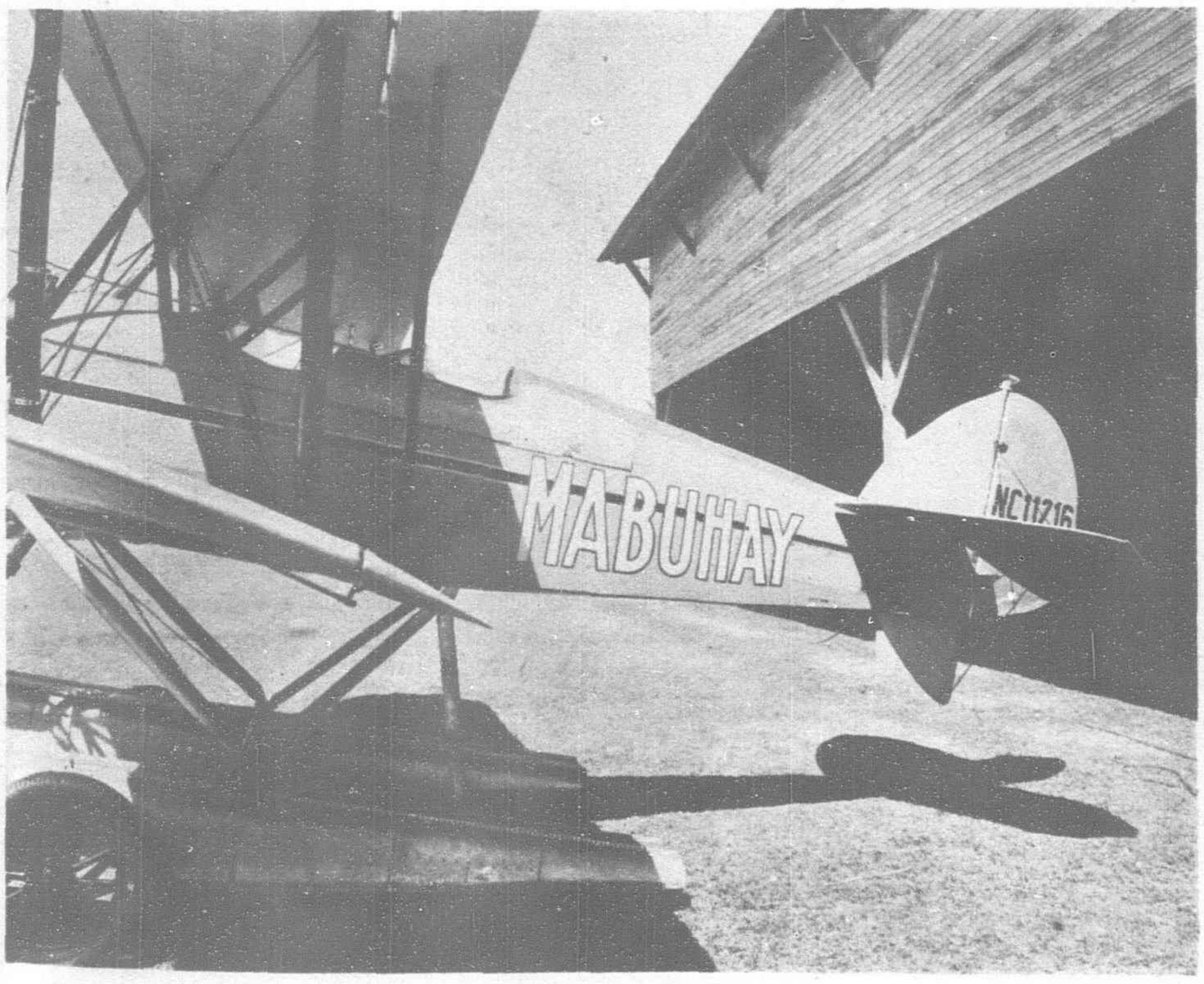


Units of the Taxi Fleet—On the left Stinson three-passenger cabin plane; on the right, Waco Plane

Second Plane Arrives

On March 3 the second plane arrived for the Aerial Taxi Co., a Stinson cabin monoplane with accommodation for three passengers and pilot. The sedan type of fuselage, as comfortable as a luxurious motor-car, was the object of much admiration. The ship was followed in a few days by a tiny Klemm, a low winged monoplane which is being used for a training ship. It is equipped with dual control, has an eighty horse-power motor, low landing speed and extreme flexibility as well as stability.

With the Waco and Stinson in service the company inaugurated a series of Saturday and Sunday sight-seeing flights which were largely patronized in spite of the limited landing facilities due to the fact that military regulations compelled the company to forego the use of Nichols Field at the end of the reasonable period allowed them to get their planes in shape. Camp Claudio, the old war-time field, was hardly suitable and the use of pontoons on the planes did not prove practical or convenient to those who wished to avail themselves of the sight-seeing privileges. The service was furthermore curtailed by what might be termed the real inauguration of strictly commercial service.



Another view of the Waco Plane

Looming on the horizon were the June elections and candidates for the house and senate, who were financially able to embark upon a campaign by air, immediately grasped the opportunity of going after votes by that unique method. A competent German pilot, Captain Theodore Camman, with experience of war as well as commercial flying to his credit, had joined the company shortly after its formation and his reliable services for inter-island flights were available.

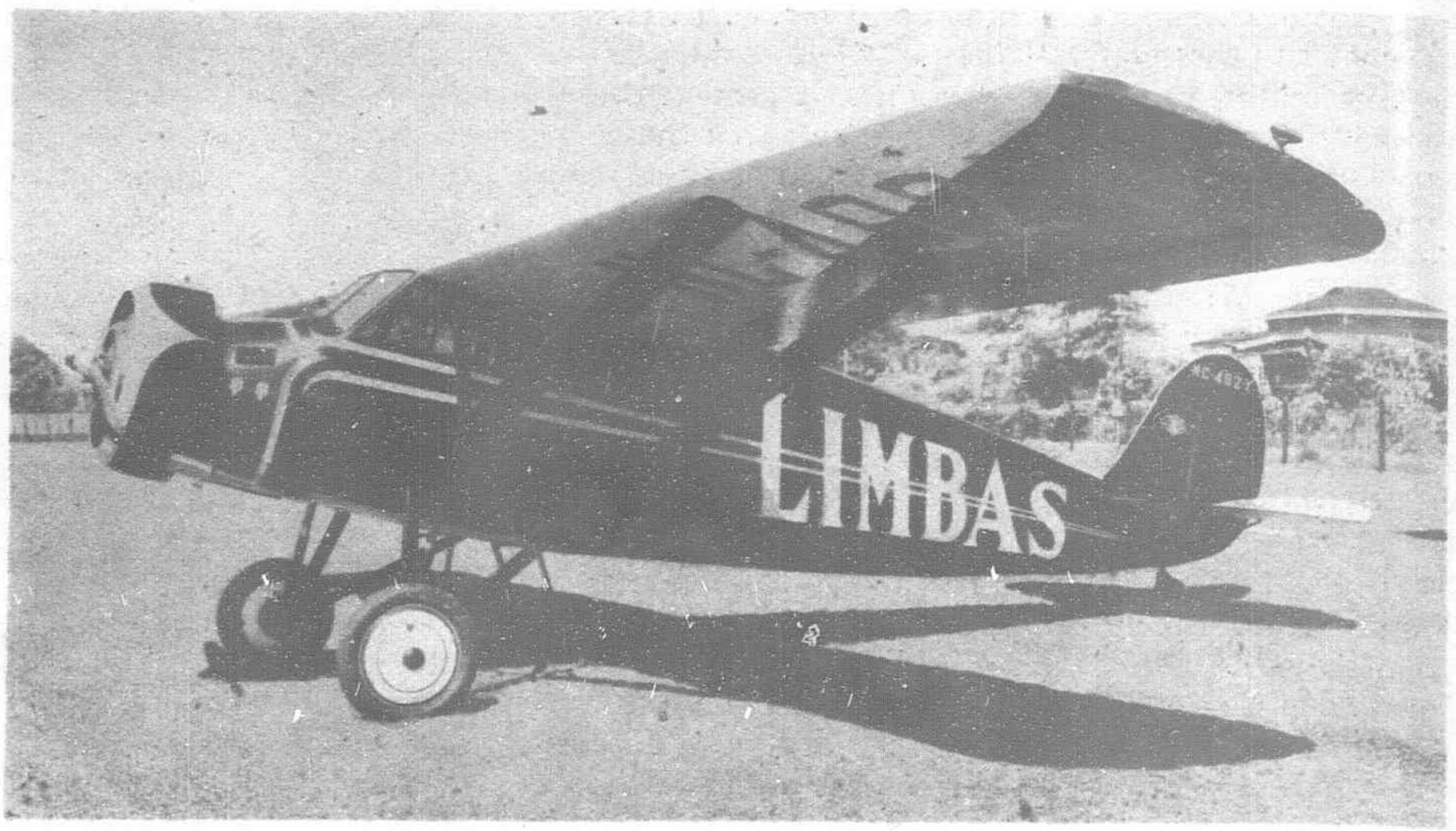
Representative Jorge B. Delagdo and Senator Jose Veloso were among the first to go out and their campaigns included everything from one to eight day flights over the southern islands, mostly in the neighborhood of Masbate, Samar, Leyee and the Camarines. From all accounts the passengers enjoyed the sport immensely but Captain Camman reported adversely as to his own personal feelings. There were landings in everything from rivers and harbors to the open roadstead He and his watchman were obliged to almost club the curious and amazed public off the ship. Asked if the mob came out in boats to see the plane the captain replied.

"Boats, you ask? They waded out, up to their necks, and the women, too, with babies on their backs. One man grabbed a strut and tried to climb aboard from a banca. I pushed him off and he yelled. 'This is my best suit that I am getting all wet.' I told him I didn't give a

damn about his suit, that my ship was worth more than all the suits in his province.

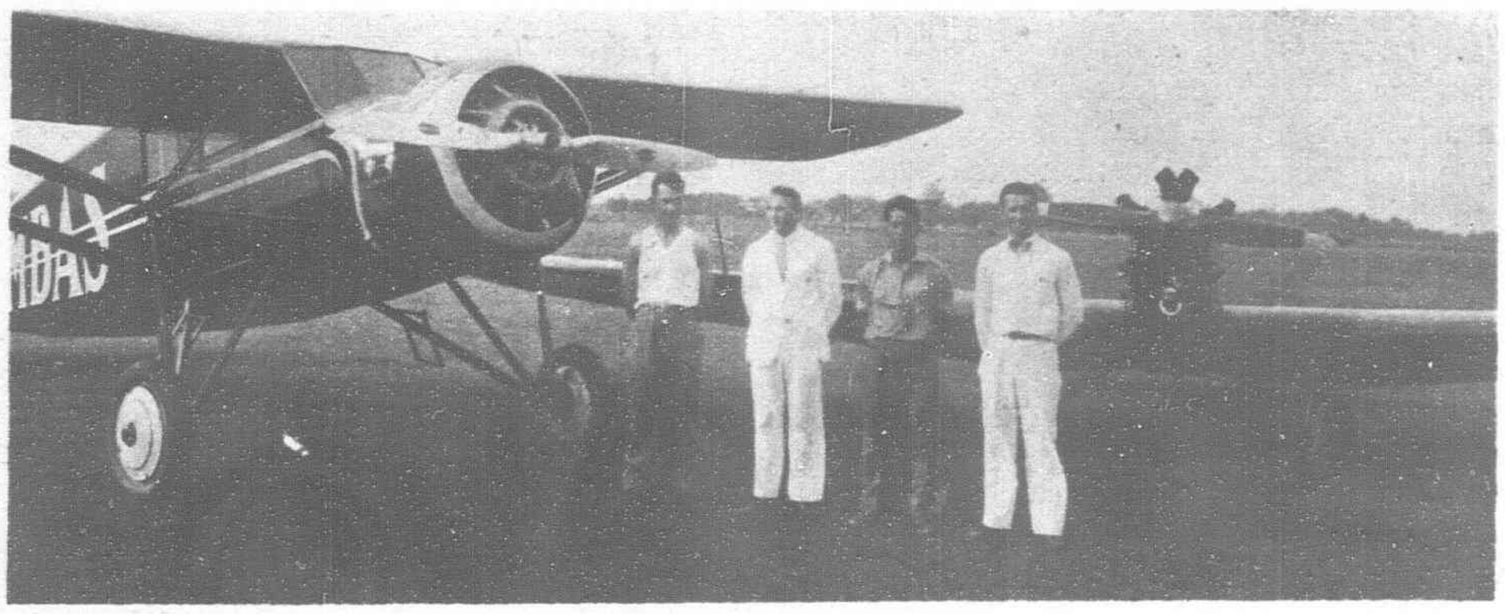
"The senator would go ashore to exhort the people and after he had been gone an hour I would send a boy after him to return, to tell him, that I had the crowd with me. It was great fun for him maybe, but for me, No. It will take a month to get my stomach right from the funny things I ate and another month to straighten out the kinks in my back from the unholy places where I had to sleep."

It is worthy of comment that all of these flights during the months of April and May were made without accident to passenger, ship or pilot, save a minor ankle sprain suffered by Captain Camman while alighting from his ship at one of the southern ports. The pontoon equipped Waco was used exclusively for all flights. During this period it also answered a hurry call from Culion Leper Colony to bring a passenger to Manila. Another extended flight included a cruise up the west coast of Luzon, over to Apparik, thence to the Batanes Islands and back through dense fog banks and then down the Cagayan valley *via* Tuguegarao, Inalga and other minor towns where landings were made on the river. For the return to Manila from Ilagan a course was steered due south to a point on the east coast almost directly east of Manila.



Showing the Stinson three-passenger plane

While the electioneering campaigns were going on the company announced a public contest for the purpose of selecting suitable names for the three planes on hand. The local press carried news stories of the plan and in one or two cases coupons were included. Nearly ten thousand names were sent in from all over the islands ranging all the way from dozens of "Mabuhays" to such curiosities as "Flying Carabao," "Doug and Mary," "Safety First," "Sweetheart of the Skies," and others. Those finally selected by a committee composed of Messrs. Carlos Romulo, Editor of the T. V. T. publications, Manuel X. Burgos of Madrigal and Co. and Angel Elizalde, Vice-President of the Aerial Taxi Co., were "Mabuhay" for the Waco, "Limbas" for the Stinson and "Patco" for the Klemm. The first name is the Philippine native word of salutation, "Limbas" the native word for eagle and "Patco" is made up from the initial letters of the company. The second Waco plane, which arrived in May, has not been named.



Men behind the machines—Left to right: A. V. Kanig, Staff Sgt., U.S. Army Air Corps, chief mechanic; W. R. Bradford, Pilot, U.S. Department of Commerce License; Procopio Laurel, mechanic; C. L. McElroy, Pilot, U.S. Department of Commerce License

Get Landing Field

Other activities during March, April, May and June included a diligent search for landing fields which, until the kindness of Archbishop Doherty offered a solution for the moment, proved a problem. The Archbishop granted the use of a well situated and extensive piece of property in Grace Park, just beyond the northern boundary line of the city, formerly occupied by the Wack-Wack golf course.

When it was found that Camp Claudio was unsuitable a small piece of land formerly leveled off for a private polo field was secured on the beach in Pasay just beyond the Polo Club. While quite ideal as a base for sea planes in ordinarily good weather it is not more than a cramped one way field which can be used only under exceptionally good conditions. In fact, the removal of the planes with land gear from that field to Grace Park reflects great credit upon the pilots. A hangar has been constructed on this field and it will be retained for sea planes.

A hangar accommodating four planes has also been built at Grace Park, a portion of the field already completed and flights from this point began during the month of June. Sundays are regular sight-seeing days, but these flights may be arranged for any day upon appointment. Lights for night flying will be installed as soon as possible, fences erected to keep out stray animals and the hundreds of children who began to flock over the field when it was opened, and the other necessary steps taken to make it a modern airport.

A close-up of the Klemm Plane

Army Flights Made

During the past six months the U. S. Army Air Corps has made a most extensive series of

flights over the entire Philippine group, augmenting the previous data already secured on aviation possibilities. These recent flights have had more to do with selecting sights for future landing fields and work is already in progress on many of them, details of which are shown on the accompanying map. These fields are always available, in emergency, for commercial aviation and every assistance is given those who are obliged to use them.

At the present time the local company operates the service that its name implies. It's slogan is, "Air Taxi!" Planes may be chartered for any point in the Philippines where a landing is feasible and this includes just about all the places where one would wish to go. As all important Philippine towns and cities are on or near the coast, save on the Island of Luzon, sea planes will be used for these trips. There is, however, an assurance that two regular services will be inaugurated immediately after the rainy season ending in October.

Of equal importance are lines to Cebu and Iloilo for mail and passengers and to Baguio for passengers first and mail second. With the coming session of the Philippine legislature it is expected action will be taken leading to the appropriation of the necessary funds for the southern mail service. As to the flights over the Baguio route there is no question whatever as to future success and the inauguration after the rains depends only upon a landing field at that point. Several are now under consideration. This popular resort is 175 miles north of Manila, a little over six hours distant by train and reached by two excellent automobile highways in from five to seven hours depending upon the mood of the driver. To such an extent has Baguio's fame spread that early this year cables were received from nearly all of the cruise ships from Singapore, Java and Zamboanga asking for air rates from Manila to Baguio. One pilot aboard the *Franconia* wished to charter a plane and take it up himself. To Manilans who own homes in Baguio and other enthusiasts who wish to "commute" the dream of a one and one half hour service seems near to realization.

Quickens the Mails

At present the average time for mail between Manila and Iloilo or Cebu is from 36 to 48 hours. Either point may be reached by plane in from four to five hours. Other more distant points such as Zamboanga lie within a proportionately short period.

The Aerial Taxi Co. at present employes two seasoned pilots who arrived from the United States in June. Mr. C. L. McElroy came from the Curtiss Company with a varied experience as mail pilot on the St. Louis-Chicago run, transport pilot over lines reaching into Mexico and Cuba and several months with the Curtiss Flying Circus. Mr. W. R. Bradford, formerly with the Fairchild Aircraft Corporation and the Stinson Aircraft Co. received his early training during the war but like many of his companions was selected for services as instructor in the United States and never reached active service in France. A graduate of the pursuit school he was later instructor at a similar school and after the war had a wide experience in sales, operation of planes and in testing. At a recent exhibition of stunt flying at Grace Park Pilot McElroy demonstrated his ability to pull off some antics with the Klemm and the Stinson cabin plane which, while not calculated as a part of transport flying, nevertheless convinced onlookers that he "knew his stuff."

The first of July the company opened its aviation school in charge of Pilot Bradford. The initial class was limited to ten students who will be given a thorough course of instruction and receive their licenses as private flyers once they have proved themselves efficient. The licenses will be issued according to the regulations applying in the United States, which are about to be adopted by the Philippine government.

On the whole, Philippine Ariation has a bright future. Flying conditions are ideal. The islands in the Philippine group are so close to one another that there is seldom more than 50 miles of open water, making the use of even land planes relatively safe. Weather conditions may be predicted with an accuracy that assures safety during typhoon weather. Good beach landings are numerous in the event of emergency as are many river landings particularly on the Island of Luzon. Thanks to the Army Air Corps, the local company is well advised as to the danger areas and these have been marked on the maps which the pilots now use. The Coast and Geodetic survey office has divided the islands into twelve sections and is preparing elaborate maps for each of them, two now being available. These maps include minute data of every description regarding tides, depths, direction of air currents, temperatures, and anchorages. Fortunately the danger areas as located by the Army flyers are in sections where it is doubtful if a plane would ever be called into service.

Although the local company has plenty to accomplish in establishing its local lines it is not unmindful of the possibilities in a Manila-China service with special emphasis on the mails and this feature of its field of endeavor is receiving due consideration. The initiative and enthusiasm of its directors and stockholders is also an earnest of its future success.

Below are specifications of the airplanes owned by the Philippine Aerial Taxi Company:—

WACO PLANE No. 1:—Three place open biplane, powered with Wright J-6 5-cylinder motor, with electric starter and metal propeller. Mounted on pontoons. 165 horse-power.

WACO PLANE No. 2:—Three place open biplane, powered with Wright J-6 5-cylinder motor, with electric starter and metal propeller. Mounted on pontoons. 165 horse-power.

STINSON PLANE:—Four place cabin monoplane, powered with Lycoming 210 horse-power motor, with landing gear.

AEROMARINE-KLEMM PLANE:—Two place, dual control, low wing monoplane, powered with the LeBlond 85 horse-power motor, wooden propeller, mounted on land gear.

Haneda Airport nears Completion

The Japanese International Airport at Haneda which has been in the course of construction since two years ago at an estimated cost of Y.2,300,000 by the government is nearing completion. The Communications Department is planning to hold an elaborate opening ceremony on the occasion of its completion which is set for the middle of October at the latest.

The new airport, one of the largest and best equipped of its kind in the Japanese Empire, covers an area of 160,000 tsubo of which 60,000 tsubo are paved and 10,000 tsubo are covered with lawn. The paved ground is provided to facilitate the take-off of planes during the winter and rainy seasons.

The new airport is suitable for a take off from land as well as from the sea. The Aviation Bureau of the Communications Department on Monday state that the ground will be available for air traffic before September this year, although the opening ceremony will be held at a later date.

To Build Hangars

The hangars belonging to the Japan Air Transport Company, The *Asahi Shimbun*, the *Nichi-Nichi Shimbun*, and other companies are being built on the ground and upon the completion of the airport all planes from foreign countries coming to the Japanese Capital will land at this airport.

A large earthquake proof concrete building which is to house the branch offices of the Aviation Department, Japan Airport Transport Company and other bodies interested in aviation in Japan, is under construction and is expected to be completed before the end of this year.

A bridge over the river which runs along the western limit of the field is also being constructed. Upon its completion it will serve as a connecting link between the field and Kawasaki district.

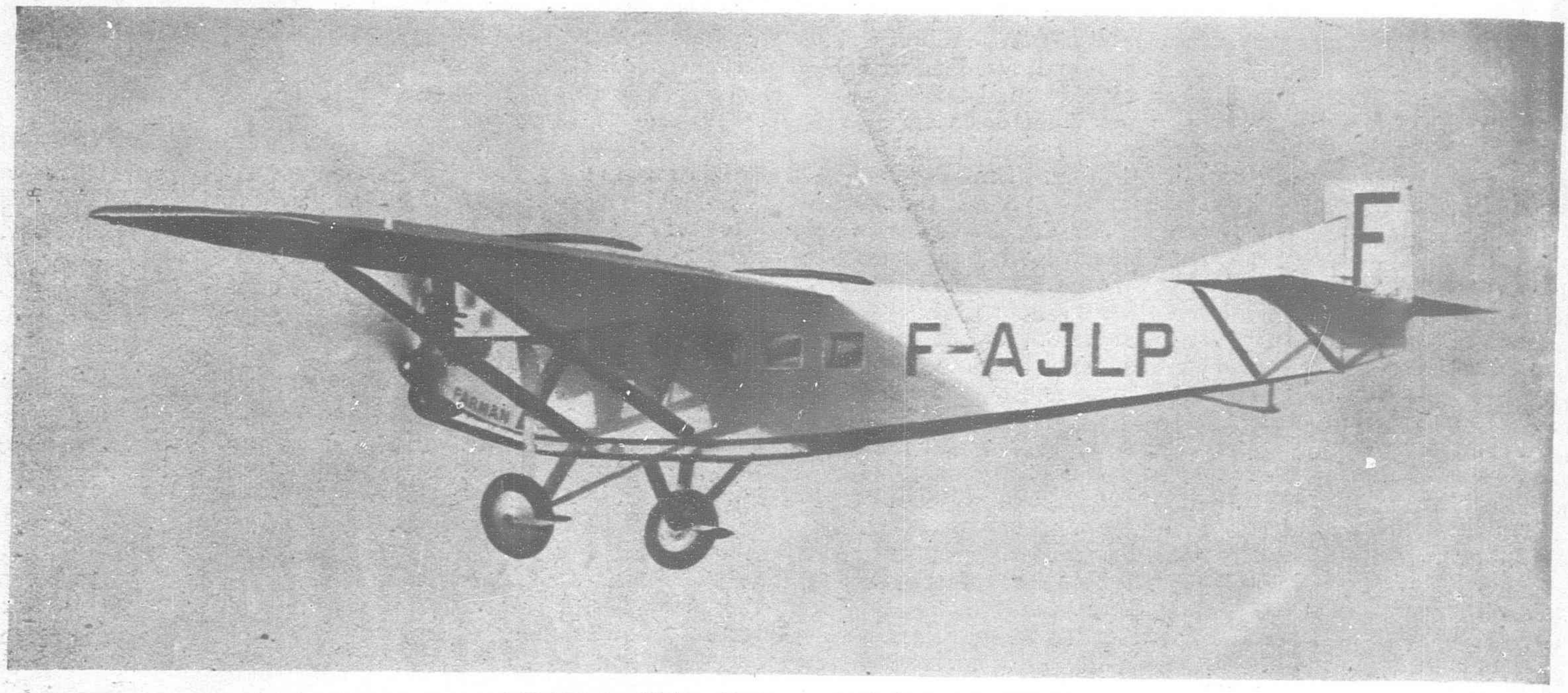
To Open Customs Office

An observatory and a branch of the Yokohama Customs will also be established on the grounds to facilitate air travel for passengers.

The branch of the Imperial Customs is to be built in view of the fact that in the future there will be international traffic by air.

On the occasion of the opening ceremony the Aviation Bureau of the Communications Department is planning to hold an air pageant in which more than twenty military, naval and civilian planes are expected to take part.

Japan is to be congratulated on the fact that she at last owns a well laid out airport in the vicinity of Tokyo, the capital of Japan, and of Yokohama the gateway to the Empire.—*Japan Times.*



A Tri-Motor Cabin Airplane of Air-Orient in Flight

Air Route from France to Indo-China

Of the difficulties which have until now held back the full development of Indo-China, the slowness of communications ranks as the first.

It takes from 26 to 30 days from Marseilles to Saigon or Hanoi by the most rapid steamer. This is too long for ordinary postal communications, as a minimum of three months is required before a reply to a query can be received. Cabling is an alternative, but this is of course very expensive. This slowness in transport is discouraging to heads of business concerns who wish to inspect their interests in Indo-China, as they have to neglect all other business at home, while on tour.

Only the airplane can remedy this inconvenience, and the air route between France and Indo-China, formerly only attempted by brilliant pioneers, was transformed into a regular commercial service in January last.

The commercial advantage of this service is certain. The airplane has shortened the road to commerce to the Far East. Besides Indo-China, the route takes in Syria, a territory under French mandate which has to be developed; Mesopotamia, with its rich oil-fields. But Indo-China alone, with its 20 million inhabitants, 5,500 million Francs commercial exchange and seven million postal exchanges, can guarantee an important revenue, to which must be added the revenues brought by the neighboring countries: Dutch Indies, China, and later on Japan.

On the other hand, the political interest of the newly established service cannot be denied. His Excellency the Governor-General, M. Pasquier, recognized it and proved it by his courageous flight from Indo-China to France in January last.

It now takes from 10 to 12 days to go from France to Indo-China, and this will soon be reduced to eight days or less.

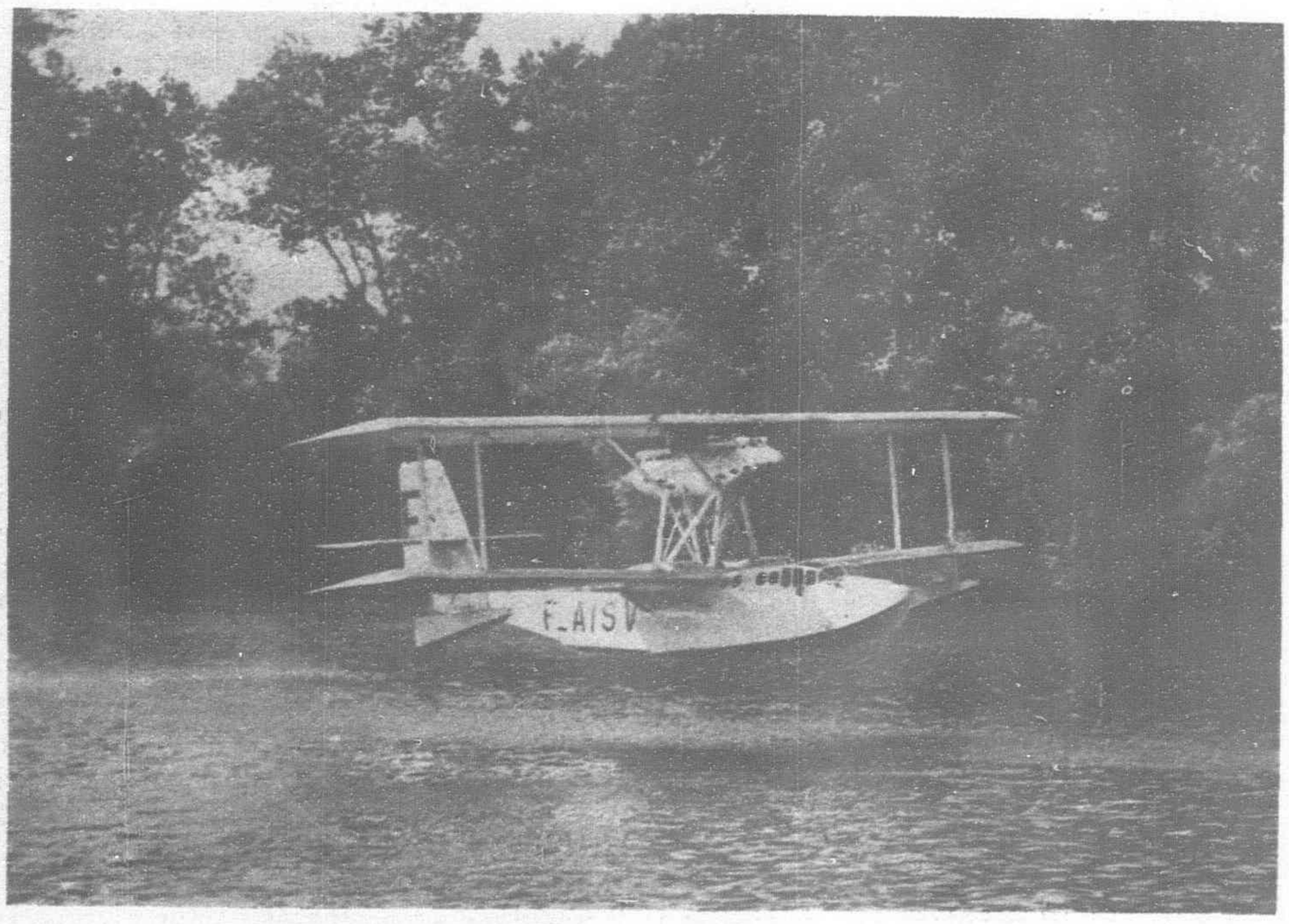
At the beginning, the service, exploited by the Cie Air-Orient, was bi-monthly, but although it was even then a success, it was found to be insufficient, as commerce requires a weekly rythm. Consequently, the Cie Air-Orient, after an agreement with the Dutch company which runs the line from Europe to the Dutch Indies, decided to increase the frequency of the service, and since April 23 the airplanes of the company have left Marseilles every Thursday, and Saigon every Friday.

From a technical point of view, the traffic is assured between Marseilles and Beyruth by the service of hydroplanes which have been running for more than two years.

From Damascus to Saigon, the route is served by three-engined planes, which follow the classical itinerary: Gulf of Persia, the Plain of the Ganges, Burmah.

For the time being, the service is only used for carrying mail, but it will soon be open to passenger traffic, and tourists will undoubtedly prefer the wonderful swiftness of the airplane to the lulling slowness of the big steamer.

(*Continued on page 503*).

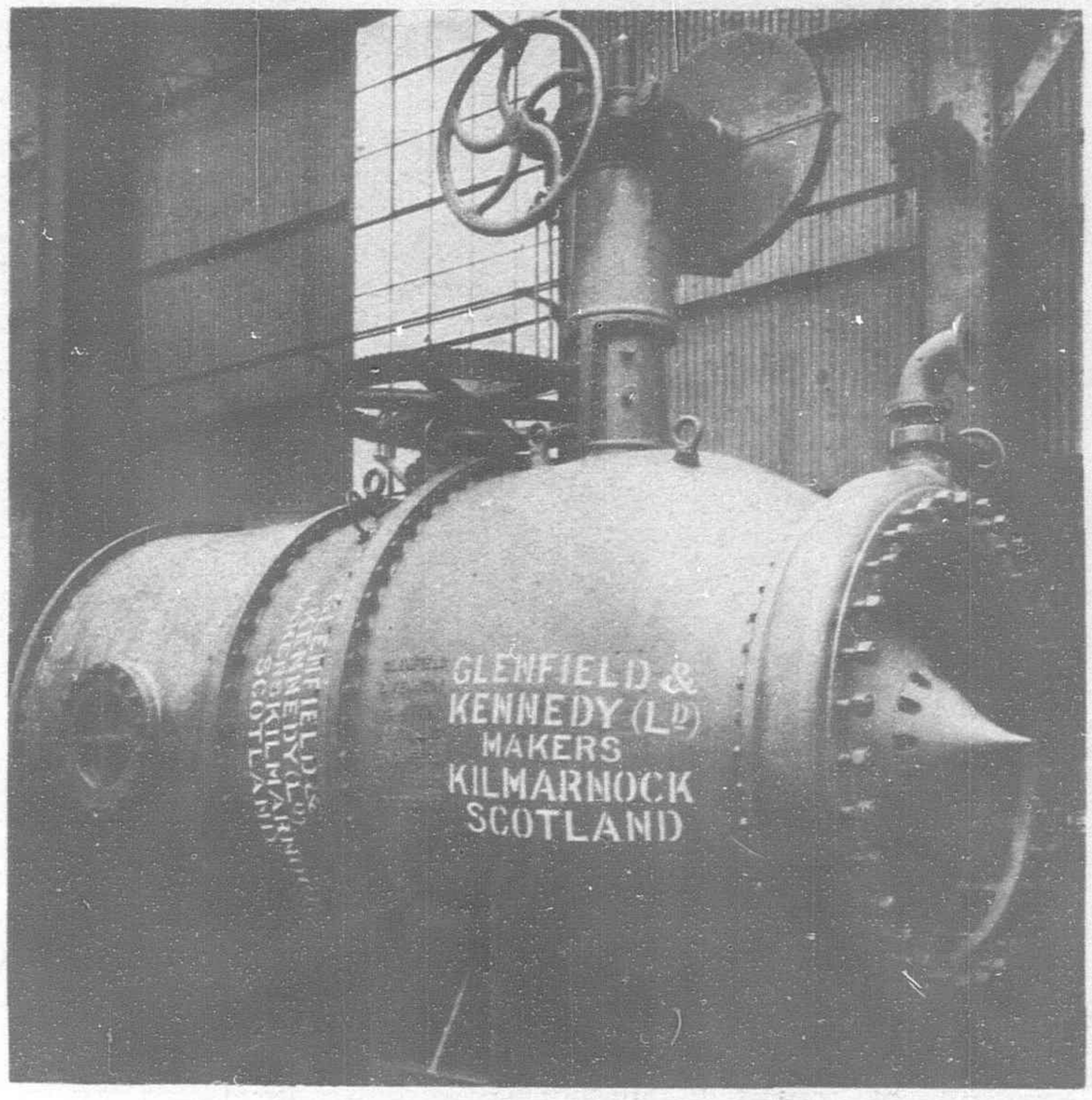


Another Plane of the Air-Orient Service

The Cauvery Metur Dam

A Notable Irrigation and Hydro-Electric Scheme in India

Of great interest is the Cauvery Metur Dam scheme on the Cauvery River now under construction near the township of Metur in the Madras Presidency, and in this connection we are able to reproduce herewith a photograph of one of the "Glenfield" 102-in. to 72-in. needle valves, fitted with jet dispersers, that are being supplied. The dam itself is to be 175 feet high, and on completion will impound a lake having a water surface of 59¼ square miles, with a capacity of 93,500,000,000 cubic feet, for the irrigation of 30,000 acres of land, the minimum flow of the river being 800 cusecs (cubic feet per second), although the figure is very variable, and in July 1924, for example, amounted to 456,000 cusecs. Because of the head and the volume of water available, four turbines are to be installed for the generation of electricity, the dam being pierced with four culverts, 8-ft 6-in. diameter, each provided with a corresponding turbine. For this scheme a large contract has been awarded to Messrs. Glenfield and Kennedy Ltd. of Kilmarnock, Scotland, which comprises some highly interesting equipment, including 29 large sluice gates, an entirely new design of emergency roller sluice gate, and mechanically operated needle valves and jet dispersers. During the buildings of the dam, and until the power station is constructed, four of these 102-in inlet diameter needle valves will be operated fitted with 72-in. effective-diameter jet dispersers, each of which will pass 2,000 cusecs under a head of 180 feet. In this way the impounded water before the turbines are operating, can be passed down to the river without difficulty, all the energy being harmlessly dissipated by the dispersers, forming a vast spray of billions of water particles, each cushioned by the air resistance, instead of a solid bore of water. The sixteen free roller gates on the spillway are 60-ft. 0-in. wide between piers and 20-ft. 0-in. deep, both hand and electrically operated, while for regulating purposes 13 sets sluices are provided, eight at a high level, with a waterway 10-ft. 6-in. wide by 16-ft. 0-in deep at a head of 80 feet, and five at a low level, each 7-ft. 0-in by 14-ft 0-in. deep with a head of 145 feet. The four hydro-electric culverts are 8-ft. 6-in. diameter and are lined with cast iron flanged pipes in 9-ft. 0-in. lengths, with bifurcated entrances so that altogether there are eight inlets, of rectangular section, each with a double screen 25-ft. 0-in. high by 7-ft.0-in. wide. This bifurcation unites at the entrance to



an 8-ft. 6-in. culvert where an emergency gate well is provided from the top to the bottom of the dam into which can be lowered the special new design of emergency roller gate to cut out the culvert for examination or repair. Further, the connection between the emergency gate frame and the 8-ft. 6-in. pipes is a special taper casting, weighing 16 tons, to fit the rectangular gate opening, and the combination on these lines of hydro-electric equipment with irrigation barrage work is a noteworthy feature of the scheme.

"It Takes a Lockheed to Beat a Lockheed"

(Continued from page 496).

year with "Wasp," but represent the complete accumulation of information available. Many operators were not in a position to furnish the information desired and others were eliminated because of the fact that their operations had not covered a sufficient period of time to be significant. The maximum number of hours on any of the engines included in the computation is 885 and the minimum 512. Arbitrary figures for depreciation, cost of labor, and cost of fuel and oil have been used. These figures may be high or low as conditions vary among operators.

OPERATIONS COSTS OF PRATT AND WHITNEY "WASPS."

Depreciation—15,000 hours—@ G$7,200	G$4.80/hour
Cost of parts—List G$0.49	.49 ,,
Cost of labor—At G$2.50 per hour	1.44 ,,
Cost of fuel —At G$0.20 per gallon	4.57 ,,
Cost of oil —At G$0.85 per gallon	.72 ,,
TOTAL COST PER HOUR OF OPERATION ..	G$12.02/hour

These figures become significant to the layman only in juxtaposition to a consideration of the operations costs for the engine in a motor-car. Were we to say conservatively that the P. & W. "Wasp" will enable the ship to attain an average cruising speed of 120 m.p.h., the operations costs being approximately G$12.00 per hour, we may say the operations costs are about 10 cents per mile.

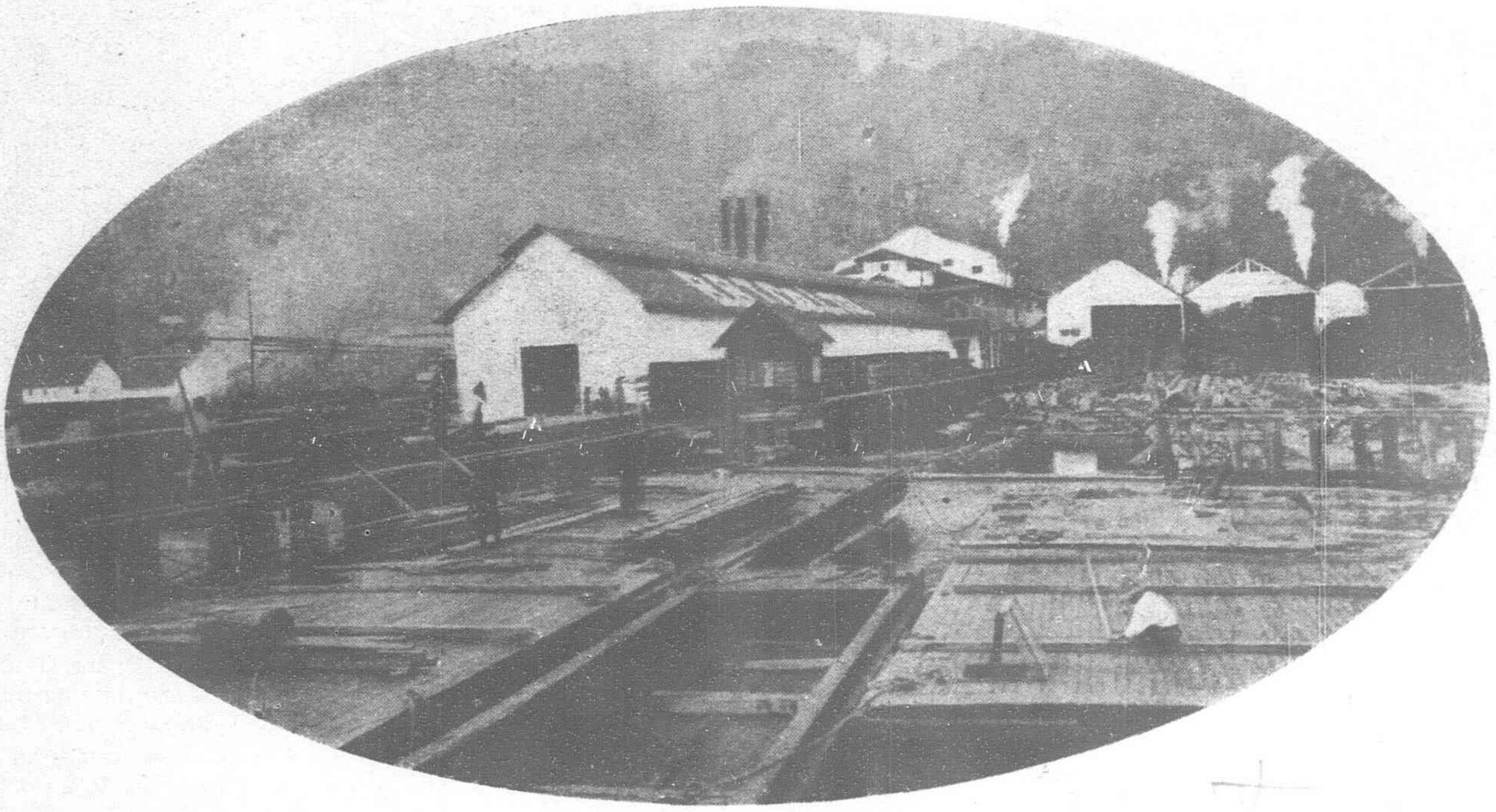
Air Route from France to Indo-China

(Continued from page 502).

The airplane leaves Marseilles and first flies over the coast of Provence, with its red rocks emerging from purple gulfs, and then above the Corsican peak surrounded by clouds. Further you will notice a white spot: Rome, the eternal city. Vesuvius will point out Naples and her bay. The Apennines, Corfu, the Island of Nausica with her silvery olive trees. Then Athens, and one recognizes a tiny Parthenon. Further on the Rhodes of the Knights, Chypre, Beyruth leaning against the mountains of Liban, Damascus, gate of Araby. And then the desert striped with caravans and motor car tracks, and scmetimes brightened by groups of tents. Then the Tigris and the Euphrates which remind you of the battles of Alexander, the great conqueror, and of so many other battles.

Bagdad and Bassorah, the Persian coast, the desert of Gedrosie with its white pointed rocks; Djask and this gulf which is never crossed, on account of the millions of sharks playing in its waves· Karachi and Jodhpur, dominated by her citadel; then the Ganges valley, with Allahabad and the holy Benares; then a long country of thick jungle, which is succeeded by a country of small wooded hills and of low rocks between which run delicately tinted rivers. The airplane then flies above rice fields divided by small silver streams. Then there is Rangoon, the Birman mountains of such forbidding aspect, and Bangkok; further the tropical forest, the Angkor ruins, and then Saigon.

Only ten days elapsed since leaving the coast of Provence and the islands of Hyeres.



Sawmills of the British Borneo Timber Co., Ltd., at Sandakan

British North Borneo Logging Methods

BORNEO consist of four geographical divisions, the largest being Dutch Borneo. The second sector in area is Sarawak, under British protection, ruled by Sir Charles Brooke, the third descendant of the famous Brooke family, whose ancestors rendered valiant service in clearing the seas of pirates who preyed upon commerce. The third geographical division is British North Borneo. This territory was ceded to a British chartered company. The fourth territorial subdivision in Borneo is Brunei, ruled by a Malay sultan. This area is also a British protectorate.

The general stand of timber found growing in British North Borneo, is quite similar to that of the Philippines. The distance from Sandakan to Manila is about 700 miles. One of the most valuable species is billian. The timber weighs 85 pounds to the cubic foot. The wood is black in color and is very highly prized by the Chinese, who have used it for more than 200 years in the manufacture of carved furniture, which is shipped to nearly every country in the world. Billian piles resist the attack of the teredos and are employed in wharf construction. Billian is found growing only in Borneo, which country, by the way, is not inhabited by tigers, common in Java, India and the Malay States.

The growth of the timber is rapid, amounting to about one inch in circumference per year. The main markets in order of procedure are: China, Japan, Australia, United Kingdom and the United States. The bulk of the export is in logs. The logging is carried forward on a selective basis, and except where the heavier species are required for piling or long lengths, trees under two feet in diameter are not felled. Of the nine commercial species, three, comprising 25 per cent are sinkers. The trees will run in height from 80 to 120 feet to the first limb. The average girth of the logs is nine feet.

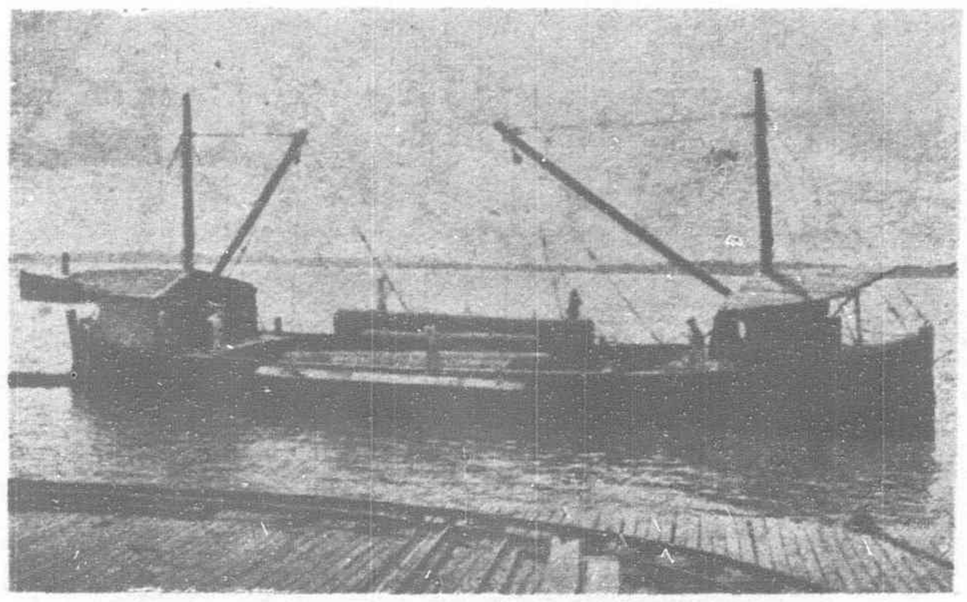
The commercial forests of British North Borneo include 2,000,000 acres within 20 miles of the coast. The average density of the stand is 25,000 board feet to the acre. The stand consists of nine merchantable logging species expressed in the following percentages:

Lauan	20 per cent
Apitin	14 ,,
Bagtican	12 ,,
Camphorwood	11 ,,
Yacal	11 ,,
Manggasinora	9 ,,
Tanguile	9 ,,
Billian	8 ,,
Ipil	6 ,,

The red lauan tree of British Borneo produces a timber which is red in color throughout. The white lauan, which is a botanically distinct species, produces a wood that is entirely white in color.

The North Borneo company owns a freehold of 85,000 acres. Elephants occasionally cause trouble, but the men on the rubber and cocoa-nut plantations are greater sufferers from this cause than the loggers. Mosquitoes, leeches, clouded spotted leopards, rhinoceros, apes, and honey bears are the principal animals encountered by loggers in the jungle. The snakes are not deadly. One of the greatest menaces to the logger

Steam Logging in British North Borneo



80-ft. Lighter Equipped with Hand Winches for lifting sinker logs on the B.N.B. Coast

Borneo Loggers Rolling a seven foot Lauan Log

is the crocodile, which attacks while the logger is engaged in building rafts in the streams. The crocodile attains a length of 14 feet and up to 30 feet. It seizes its victim generally by a limb and submerges him. Since it is the instinct of the crocodile to deposit his prey on the banks of the river, to be eaten later, it is possible in some cases to recover the body.

The Borneo loggers are very loyal to each other. When one of their comrades is attacked they immediately go to his rescue, which is sometimes effected by the natives sticking their fingers in the eyes of the crocodile, causing it to relax its vice-like grip of the victim.

There are large quantities of wild hogs in the jungle which are eaten by the Chinese loggers. The Malay is a Mohammedan and, therefore, does not eat pork, leaving an abundance of pork chops for the Chinaman, who is made happy. There are no Fridays in the Chinese gastronomic calendar.

The sawmill of the North Borneo Trading Co. is mainly employed to convert logs which, by reason of defects, are not exportable and to supply for the local trade. The principal business of the North Borneo Trading Company is the export of logs, consisting chiefly of red and white lauan, tanguile, apitong and billian. The principal importing ports are Liverpool, Glasgow, London and Hamburg, Germany. Logs are also exported to the United States. Buffelen Lumber & Manufacturing Co. and Wheeler-Osgood Company, Tacoma, Washington, are importers of Borneo logs.

The machinery of a British Borneo sawmill consists generally of a frame headrig, equipped with four vertical saws. The blades are eight feet in length.

There are three sawmills operated in Sandakan. North Borneo Trading Co., A. E. Philips, general manager, is equipped with one saw frame. The annual lumber cut is 2,250,000 feet, board measure. British Borneo Timber Co., S. D. Key, manager, operates a mill equipped with an American band mill and a horizontal resaw and two saw log frames. Annual lumber production is 8,000,000 feet. High lead system of logging is practiced. Kim Eng Watt, a Chinese firm, operates a double circular rig. The annual lumber production is about 1,000,000 feet.

Two Chinese firms which export logs to China but do not operate sawmills are Yong Soo and Man Woo Long. The demand for Borneo logs and timber is constant and the markets are increasing. The prices have remained very stable.

The climate of British North Borneo is humid. The thermometer ranges from 72 to 94 degrees Fahrenheit. The average rainfall is about 70 inches. It will be remembered that in Borneo there are high mountains. Mount Kinabalu has an elevation of 13,900 feet and at rare intervals the crown is covered with frost. As a general rule the country is level. The water is fair, but is generally boiled before being used.

The sultan of Suluk, who makes his home at Jolo in the southern Philippines, formerly enjoyed certain rights over the Sandakan area, now included in British Borneo. The Suluks are a distinct race and were not head hunters, being imbued rather with piratical tendencies. The sultan of Suluk, with his harem and attendants, journeys at regular intervals from Jolo to Sandakan, a distance of 500 miles, to receive the rental due from the chartered company which controls British North Borneo. The payment is in Singapore dollars.

In any discussion regarding the independence of the Philippines the attitude of the Suluks would have to be reckoned with. The Suluk, being a Mohammedan, has the usual conviction that infidels in his country should take a back seat, and would not spare the Filipino. The Mohammedan religion does not permit its followers to commit suicide, but they may sharpen their long knives and attack their enemies and die with honor in battle.

New Edgar Allen Catalogs

The second edition of the Crushing Rolls pamphlet of Edgar Allen & Co, deals concisely, but completely, with high speed and medium speed crushing rolls, cubing rolls, coal crushing rolls, coke crushing rolls, etc. The pamphlet of 16 quarto pages.

The latest edition of the Edgar Allen "Stag Single Roll Crusher" pamphlet deals with a machine suitable for reducing coal, chalk, lump lime, etc., from 4in. down to about 1in. cube. The pamphlet gives full specifications of the machine, with the approximate output in tons per hour, and gives details of the information required to enable enquiries to be dealt with promptly.

The 7th edition of the Edgar Allen booklet on "Stag High Speed Steels" covers the complete range of their high speed tool steels, beginning with the super steel known as "Stag Major," and concluding with the "Stag" air-hardening quality containing 14 per cent tungsten. The practical notes contained in this booklet include paragraphs on forging, hardening, quenching, secondary hardening, annealing and hardening of special tools. There are also sections on angles for the cutting edges of turning tools, on grinding high speed steel tools, and on how to order high speed steels.

The 4th edition of the Edgar Allen K.B. Pulverizer and Granulator catalog, entirely replaces all previous editions. Full particulars are given of the use of the machine as a granulator, which is a new development. Materials such as gravel, granite, whinstone, slag, etc., can be reduced to chippings, whose cubical form is outstanding. The all-steel construction of the machine, and the fact that it runs at a low speed when granulating, make it very suitable for use in quarries, gravel plants, etc. Data on outputs, when operating on limestone, gravel, coal etc., and given in a table, also typical gradings of products being obtained at K.B. Pulverizer installations.

Trans-Pacific Radio in North-Eastern China

(Continued from page 492).

transmission to Europe which terminates in the Berlin Transradio system.

With these two international high-speed and direct connections Mukden has an outlet for telegraphic despatches to the Americas and Europe and other countries. Several domestic radio-telegraph stations located in the principal cities of the north-east act as feeders for the Mukden International facilities.

The completion of this new unit gives China a second direct link to the powerful assembly of RCA Communications, Inc. at San Francisco ; the first link being established from Shanghai last year.

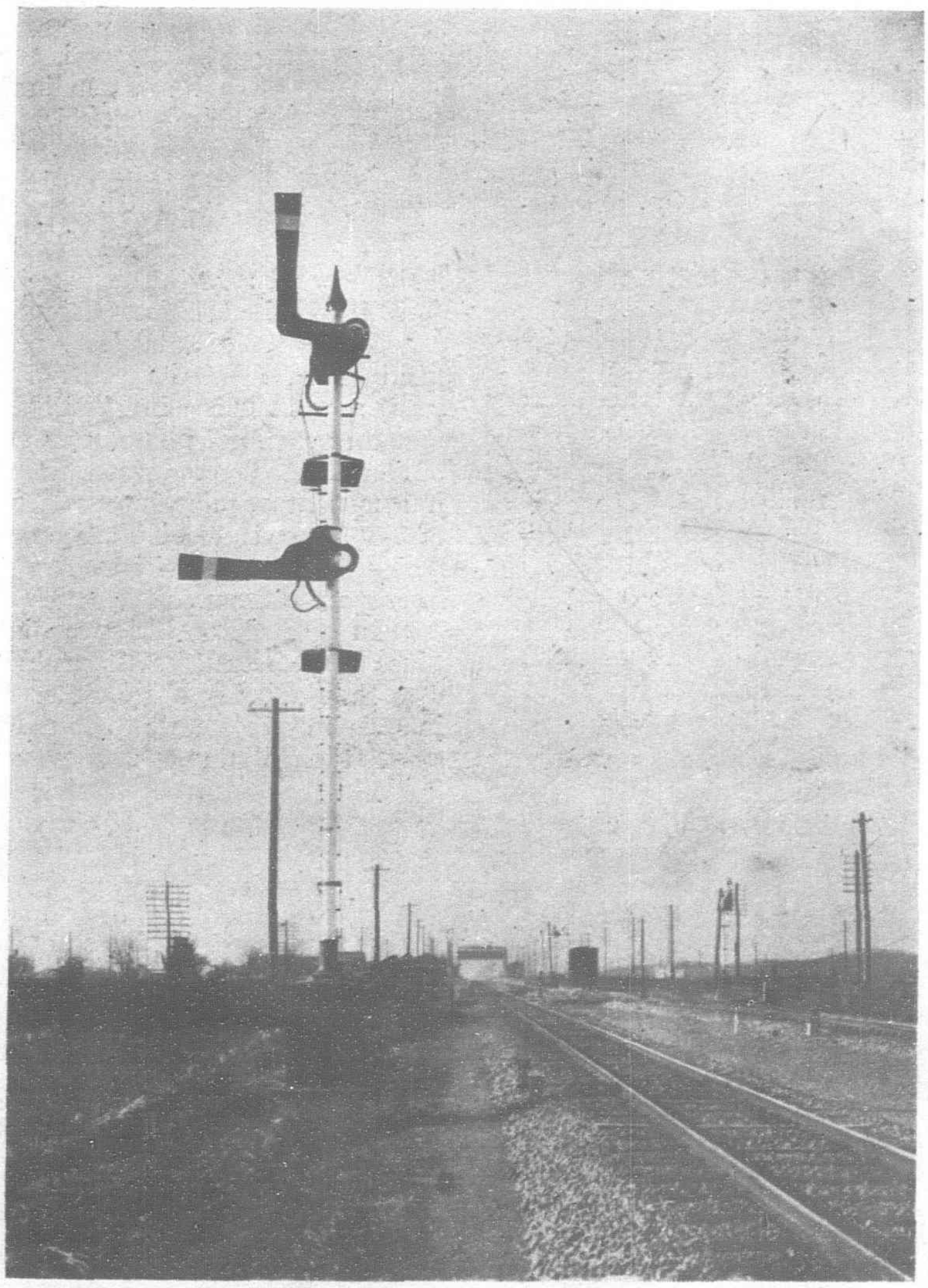
Development of Power Signaling and Interlocking on the Japanese Government Railways

By Communications Section, Bureau of Electricity, Department of Railways

It was in 1872 that railways were for the first time built in Japan, and as they have attained the present stage of development, railway signaling has also undergone various changes. At first, in the single track sections, the staff and ticket system was chiefly used, and in the double track sections, what was known as the "Tanshin" block system (a primitive block instrument with single needle) came to be adopted. In 1900, the "Soshin" block system, to which reference is made elsewhere was designed, and has been mainly used in the double track sections. In 1902, Tyer's tablet block instruments came into use, and those have been chiefly used in the single track sections. In 1914, Siemen's controlled manual block instruments were employed in the double track section between Kyoto and Kobe which were soon supplanted by the automatic block system.

Automatic Block System on Electric Car Sections.—In 1904 or thereabouts, between Iidamachi and Nakano (Chuo line, double track section), there were installed the disc type automatic block signals of the Hall Switch and Signal Co. This installation was the first of the automatic signals in the country. This signal was controlled by the d.c. track circuit employing the gravity cell, but it was very difficult to recognize against the sun.

Ever since the expansion of the suburban districts of Tokyo, the passengers of the Yamate electric line (Tokyo suburban circular line) have greatly increased which necessitated the increase of train dispatches followed by the installation of automatic signals, but as mentioned above, the disc type automatic block signals had drawbacks in respect to poor visibility, and as the single trolley system was then adopted, these signals were given up in favor of F type semaphore signals of the H.S.S. Co. which were controlled by a.c. track circuit. The installation of the latter system was started in 1912 and completed about 1917. At the same time, the entire disc type automatic block signals on the Chuo electric line were replaced by the F type semaphore signals, which were of a.c. lower quadrant two arm two position. These signals were again supplanted by color light signals through the entire system as on train sections.

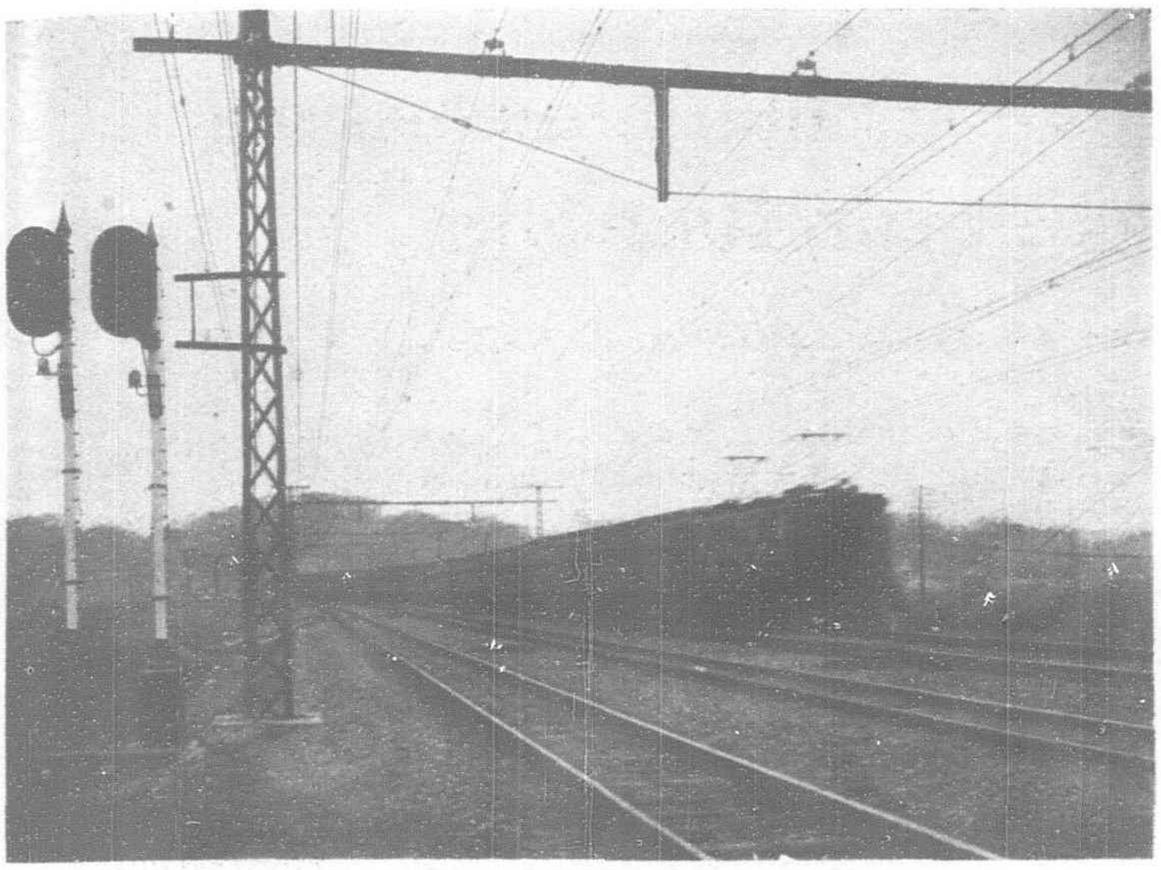


Power Semaphore Home Signal at Inage, Sobu main line

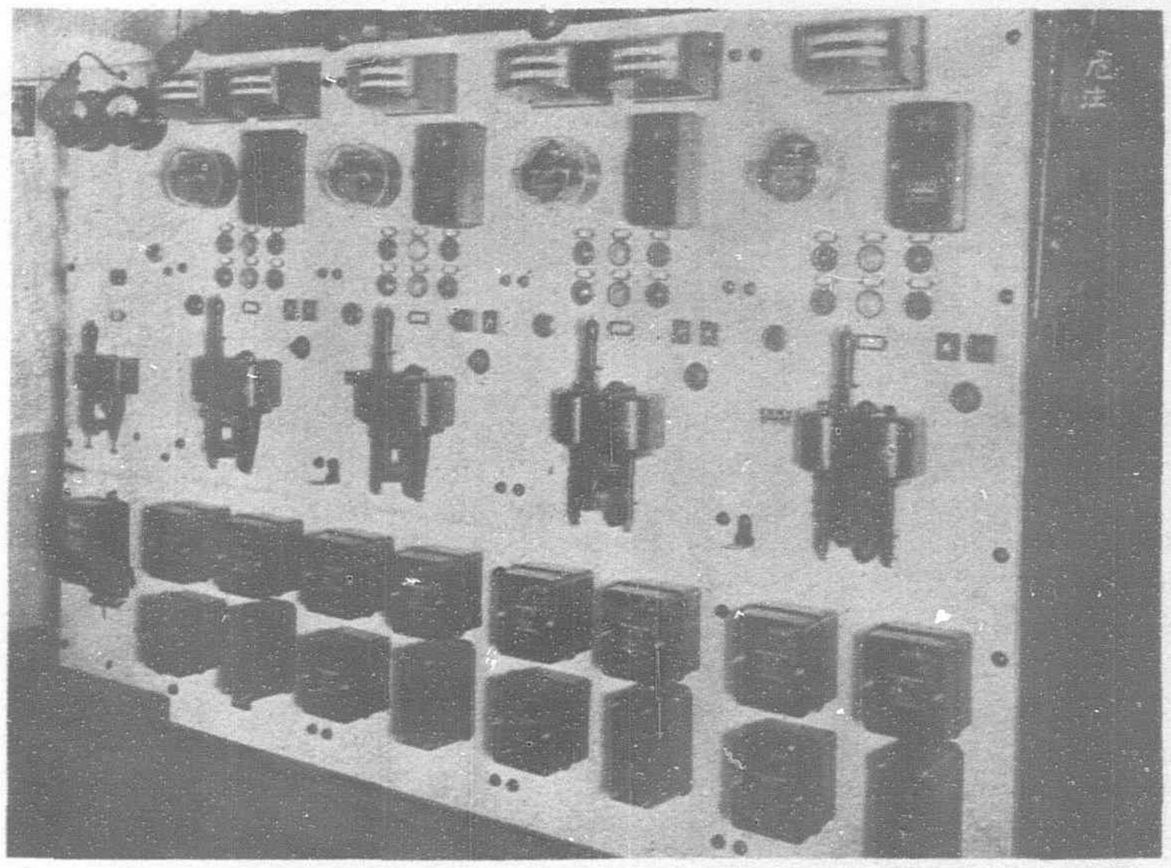
Automatic Block System on Train Sections.—In 1918 or thereabouts, Japan enjoyed unprecedented industrial activities followed by a tremendous increase both of passenger and freight traffic on the Tokaido and other lines, overloading transport capacity to the utmost limits, and in order to relieve the congestion, various plans were proposed. It was finally decided as a relief measure to increase the number of train dispatches by means of installing automatic block signals. It was also decided to give up the lower quadrant two position type, and adopt T-2 type of the Union Switch and Signal Co. as well as 2-A type of General Railway Signal Co. which were of the upper quadrant three position type. In 1921, automatic semaphore signals were installed in succession in main trunk double line sections such as Shinagawa—Kozu, Tabata—Omiya, Otsu—Akashi, Okazaki—Otsu, Moji—Orio and Ryogokubashi—Chiba.

Daylight Signals.—As a consequence of the electrification of the Tokaido line, trouble was experienced in recognizing the indications of the semaphore arm, because of the interruption caused by trolley wires, feeders and their supports. This gave rise to the study of daylight signals. The result of experiments in various places revealed the superiority of these signals. The color light signal of vertical type was adopted as the standard, and in 1925, the semaphore signals between Shinagawa and Yokohama were replaced by these color light signals for the first time. The position light signals were proposed, but they were pronounced to be ill-adapted to conditions in Japan, because of space relations. Actual experience has shown that daylight signals afforded sufficient visibility even in the daytime, while their easy maintenance and other advantages were realized, so that the semaphore signals on all the electric car sections of the Keihin, Chuo and Yamate lines, have been entirely replaced by the color light signals. Again on the train sections, these signals have been naturally in use in electrified sections such as the Tokaido Main Line between Tokyo and Kozu, and the Yokosuka and Atami lines. It was also decided to use these color light signals on steam-railway sections contiguous to the above-mentioned electric train sections, in order to avoid the confusion of signal indication caused by the use of the semaphore and color light signals. In the case of automatic block signals newly constructed, color light signals are generally adopted. It may be noted that all these color light signals are of home make. Table 1 shows the automatic signals in service in January 1929, Table 2 those under construction, and Table 3 those under contemplation.

Installation of Automatic Block Signals and Interlocking at Stations.—The chief object of automatic block signals being the increase of the number of train dispatches, they were placed only between stations or signal yards, and home and starting signals as well as interlocking between signals and switches at yards retain their old equipment, preserving interlocking relations as shown in Fig. 3. Thus in the station there is installed the three position

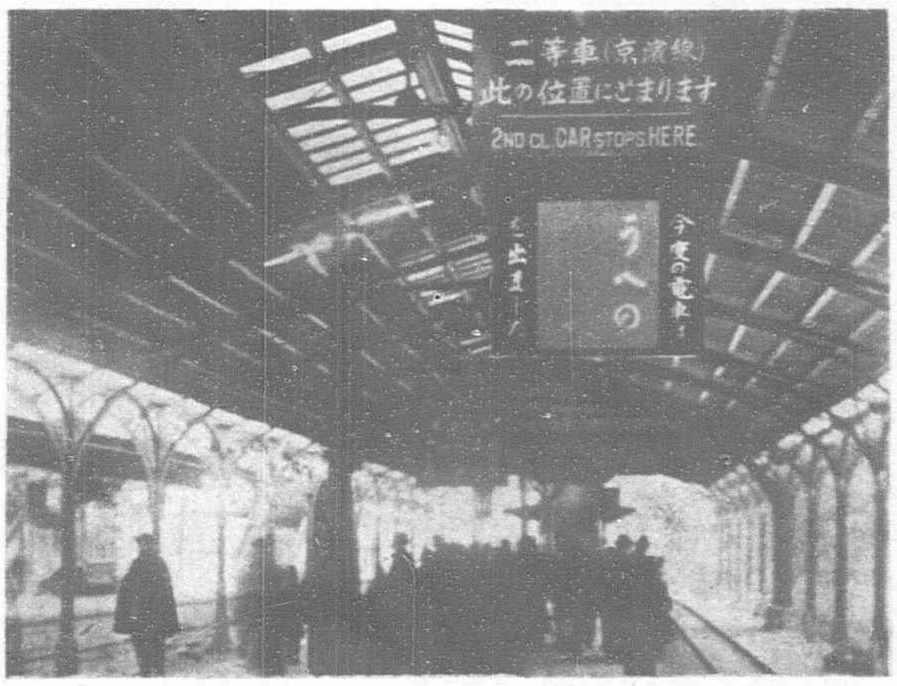


Automatic Color Light Block Signals in the territory of electrified four track between Ofuna and Tozuka, Tokaido main line



Automatic Switching Panels for Automatic Signals at Ichikawa Switch House. (from left to right: Receiving panel, panels of single-phase two circuits for South, panels of single-phase two circuit for North)

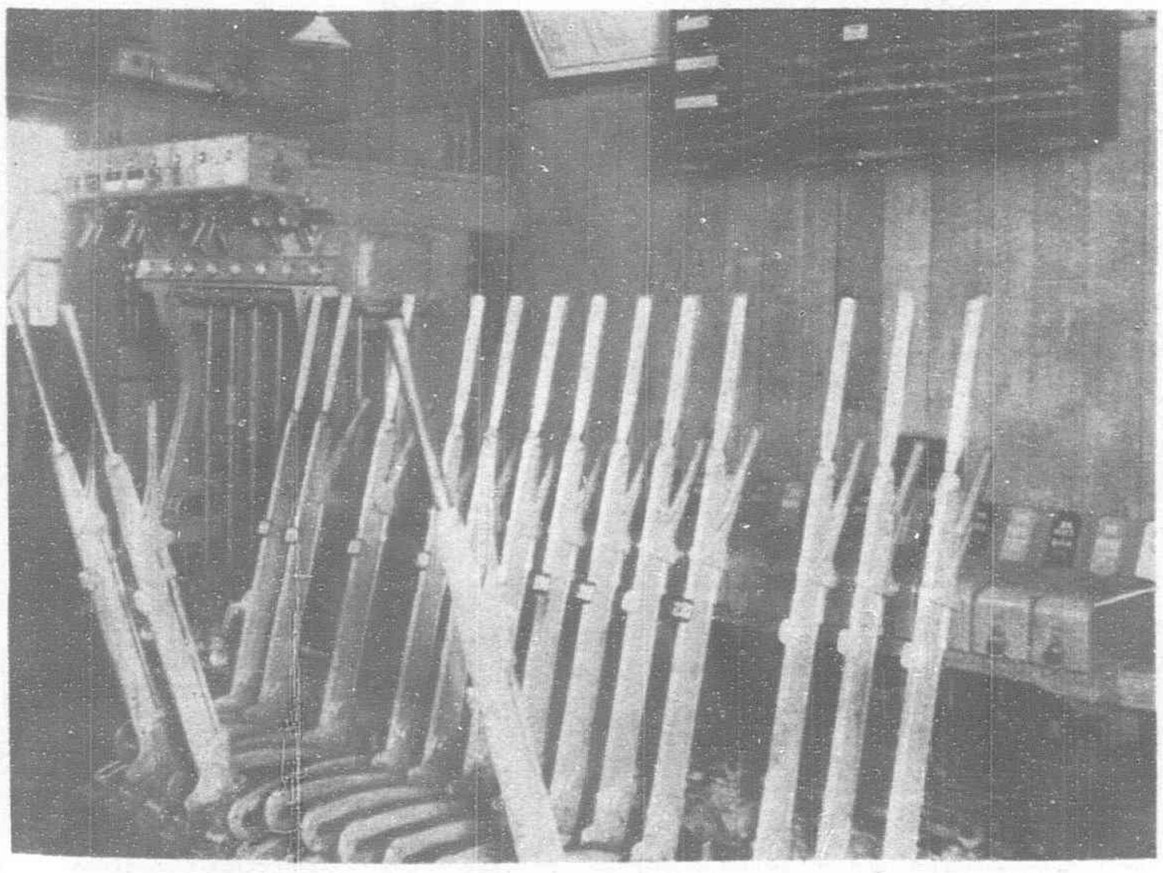
indication relay (starting indicator) worked by the condition of the first section ahead, thereby indicating whether the section is occupied or not. The starting signal lever is controlled by the electric lock attached to it, which is also controlled by above-mentioned relay. Besides, there are provided two position indication relay (arrival indicator) which moves in response to the condition of the arms of the signals in the first and second sections outside of the home signal, thus indicating whether the train is entering those sections or not. This home signal is provided with a pole changer which works in unison with the signal arm, and in case of reversing the lever to receive the train, the electric current flowing into the track circuit in the section just outside the home signal is so changed that the first signal indicates proceed. In case trains or cars have to be pushed outside the home signal for the purpose of shunting, there is a necessity of showing the stop indication by the first signal, so that there is provided an electric switch in the signal cabin.



Train Indicator at the Platform of Nippori Station, Toboku main line

Thus the posterior first signal is the semi-automatic absolute signal so that a telephone is attached to the signal post for the purpose of communication facilities between train drivers and signalmen. It is so controlled that the semi-automatic signal shows the stop indication when trains or cars get into the posterior first section and the signal retains its position even after the passage of trains through that section, but the said signal is controlled so as to show the caution signal when the home signal lever is restored to the normal position. It is carried out by means of the approach indication relay, later on, changing the 90 deg. contact position of the circuit controller of the signal.

Following the development of the intermediate signalization, the safety equipments in stations have been electrified for unifying signal indications and for the promotion of safety. The home and starting signals have been converted into semi-automatic signals. In busy stations, the signals are controlled by the mechanical signal lever of the mechanical interlocking



Electro-mechanical Interlocking Machine in Yokohama Signal Cabin

View of the Electro-Pneumatic Interlocking Plant, North End at Shinjuku

Table 1.—Automatic Block Signals in Service in January, 1929

Line	Section From	Section To	Length of Section	Single, double or four track	Semaphore	Color Light
Tokyo Division			K.M.			
Tokaido main line	Tokyo	Hodogaya	31.7	double track	—	111
	Hodogaya	Hiratsuka	32.0	four track	—	186
	Hiratsuka	Kozu	13.8	double track	—	41
Yokosuka line	Ofuna	Yokosuka	16.1	,,	—	49
Atami line	Kozu	Odawara	6.3	,,	—	24
Tokaido line (electrified)	Tokyo	Tamachi	4.7	,,	—	24
	Tamachi	Shinagawa	2.3	four track	—	20
	Shinagawa	Sakuragicho	24.0	double track	—	63
Yamate line	Shinagawa	Tabata	20.6	,,	—	80
	Itabashi	Akabane	4.0	,,	—	16
Chuo line (electrified)	Tokyo	Nakano	14.8	,,	—	87
Chuo line (steam)	Shinjuku	Nakano	4.5	,,	—	7
Chuo main line	Nakano	Kokubunji	16.0	,,	—	81
Tohoku line (electrified)	Tokyo	Akabane	14.0	,,	—	64
Tohoku main line	Tabata	Omiya	23.2	,,	—	84
Sobu main line	Ichikawa	Chiba	24.5	,,	60	—
Nagoya Division						
Tokaido main line	Fukuroi	Okazaki	87.9	,,	—	196
	Okazaki	Maibara	120.0	,,	247	38
Osaka Division						
Tokaido main line	Maibara	Baba	55.6	,,	138	43
	Baba	Kanzaki	61.8	,,	—	177
	Kanzaki	Higashinada	19.5	four track	—	54
	Higashinada	Kobe	3.7	double track	—	21
Osaka-Hoppo line	Kanzaki	Maibara	11.5	,,	—	10
Sanyo main line	Kobe	Akashi	19.2	,,	—	87
Moji Division						
Kagoshima main line	Moji	Orio	31.2	,,	73	27
Total			609.7	double track	518	1,590
			53.8	four track		

Table 2.—Automatic Block Signals under Construction in January, 1929

Line	Section From	Section To	Length of Section	Single, double or four track	Semaphore	Color Light
Tokyo Division			K.M.			
Tokaido main line (freight)	Shinagawa	Tsurumi	16.0	double track	—	40
Atami line	Odawara	Atami	20.8	,,	—	43
Chuo main line	Kokubunji	Kunitachi	3.2	,,	—	16
Sobu main line	Kinshicho	Ichikawa	10.6	,,	41	—
Tokaido line (electrified)	Tokyo	Tamachi	—	,,	—	1
Yamate line (electrified)	Shinagaka	Tabata	—	,,	—	6
Yamate line (freight)	Osaki (in yard)		—	—	—	8
Chuo main line	Tokyo	Kokubunji	—	,,	—	12
Tohoku line (electrified)	Ueno (in yard)		—	—	—	2
	Oji (in yard)		—	—	—	4
Tohoku main line	Yono (in yard)		—	—	—	1
	Omiya (in yard)		—	—	—	17
Nagoya Division						
Tokaido main line	Hara	Shizuoka	47.5	double track	—	104
	Shizuoka	Fukuroi	62.8	,,	—	135
Osaka Division						
Tokaido main line	Ibaraki (in yard)		—	—	—	9
Total			160.9		41	398

Table 3.—Automatic Block Signals under Contemplation in January, 1929

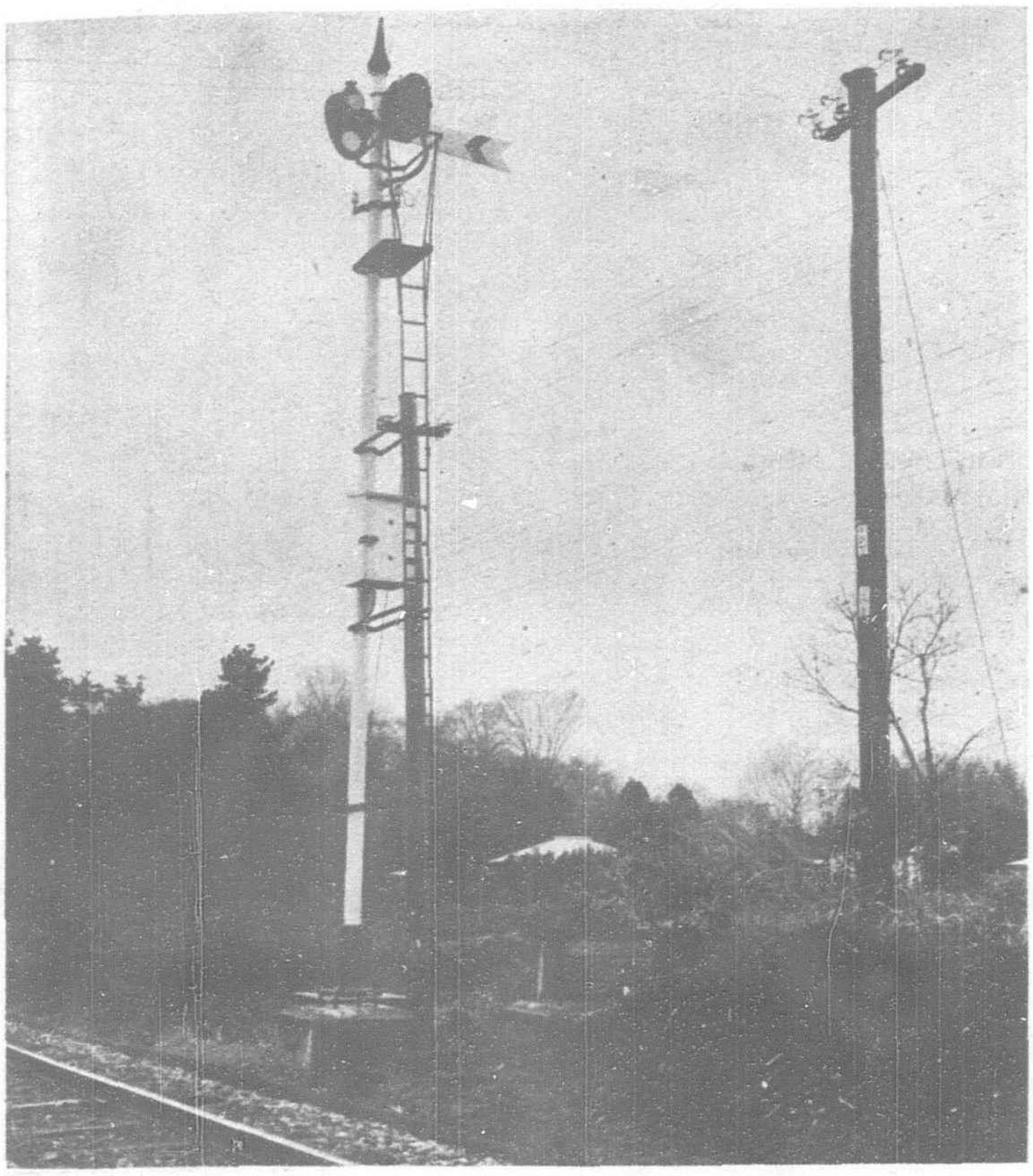
Line	Section From	Section To	Length of Section	Single, double or four track	Semaphore	Color Light
Tokyo Division			K.M.			
Sobu main line	Ochanomizu	Kameido	5.5	double track	—	23
Tohoku main line	Omiya	Utsunomiya	79.2	,,	—	168
Osaka Division						
Sanyo main line	Akashi	Himeji	35.6	,,	10	105
Kansai line	Minatomachi	Nara	41.1	,,	139	—
Moji Division						
Chikuho line	Wakamatsu	Kotake	30.9	,,	119	—
Total			191.3		258	296

Table 4.—Interlocking in Service in January 1929.

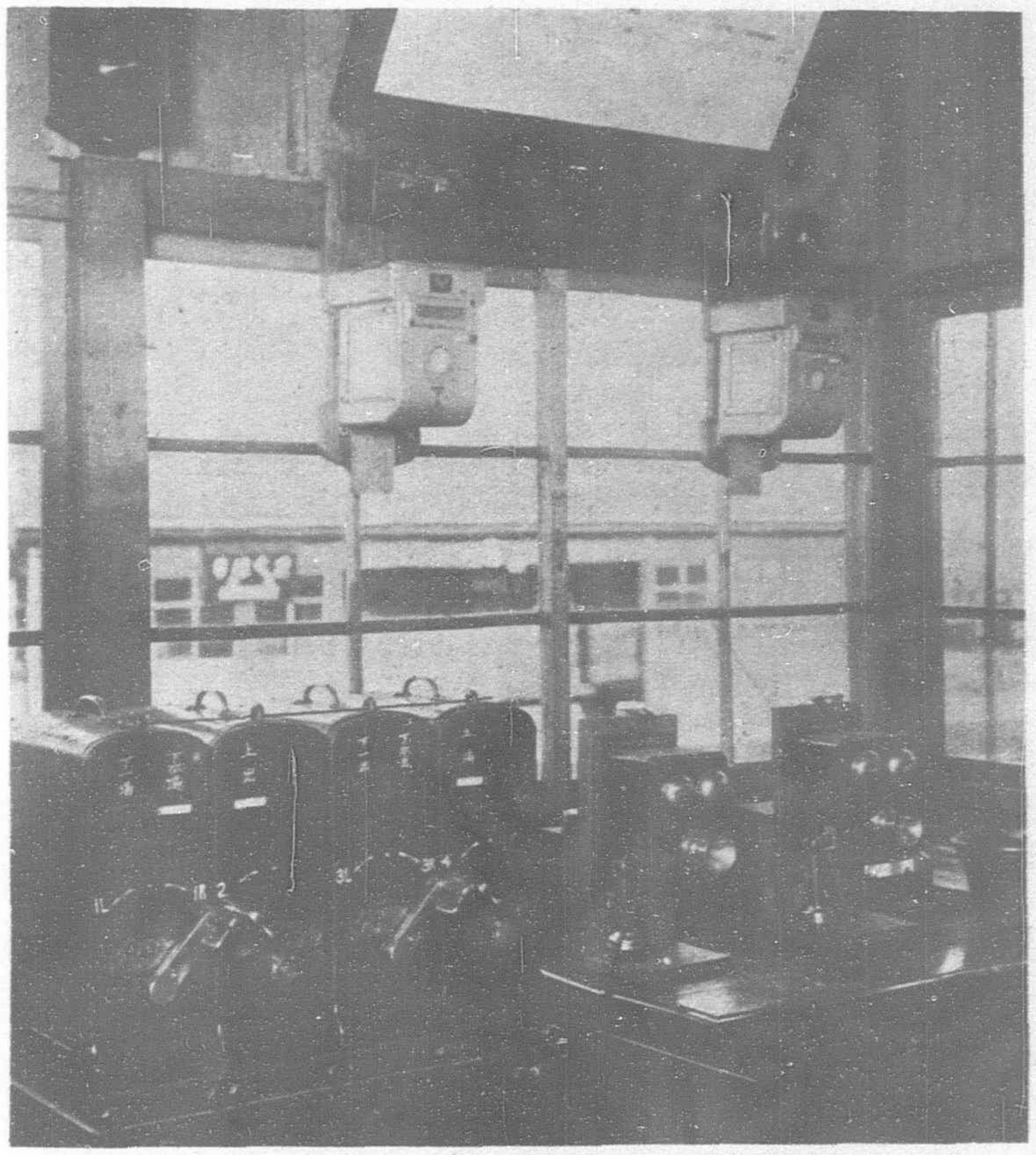
Line	Location	No. of machines Electro-mechanical	No. of machines Electric	No. of working levers	Type	Manufacturer
Tokyo Division						
Tokaido main line	Yokohama	1	—	3	a.c. forward quadrant	Tokyo Tetsudo Kikai
	Fujisawa	2	—	13	a.c. side quadrant	,,
	Tsujido	2	—	12	a.c. slide forwards	Shioda
Yamate line (electrified)	Ebisu	1	—	4	a.c. forward quadrant	,,
Chuo line (electrified)	Nakano	1	—	3	,,	,,
	,,	—	1	34	a.c. side quadrant	U.S.S.
Tohoku line (electrified)	Tabata	—	1	9	a.c. slide forwards	Kyosan
Nagoya Division						
Tokaido line	Kanaya	—	1	9	d.c. and a.c. slide forwards	G.R.S.
	Maibara	—	2	14	d.c. and a.c. slide forwards	G.R.S.
Osaka Division						
Tokaido line	Kusatsu	—	1	16	a.c. slide forwards	Kyosan
	Kyoto	—	1	4	a.c. forward quadrant	Minura
Sanyo line	Akashi	—	1	11	a.c. slide forwards	Kyosan
Moji Division						
Chikuho line	Wakamatsu	1	—	6	a.c. forward quadrant	Tokyo Tetsudo Kikai
	Orio	1	—	16	,,	Shioda
Sapporo Division						
Hakodate line	Iwamizawa	7	—	28	d.c. forward quadrant	Minura
	Total	16	8	182		

Table 5.—Interlocking Under Construction in January 1929.

Line	Location	No. of machines Electro-mechanical	No. of machines Electric	No. of working levers	Type	Manufacturer
Tokyo Division						
Tokaido main line	Ofuna	3	—	42	a.c. forward quadrant	Minura
	Fujisawa	2	—	18	a.c. slide quadrant	Tokyo Tetsudo Kikai
	Chigasaki	2	—	8	,,	Shioda
	Hiratsuka	2	—	24	a.c. slide forward	,,
Tokaido line (electrified)	Tokyo	—	1	12	,,	G.R.S.
	Shinagawa	—	1	21	a.c. slide quadrant	U.S.S.
	Kamata	—	1	22	a.c. slide forward	Kyosan
Chuo line	Shinjuku	—	3	106	d.c. slide quadrant	U.S.S.
Tohoku line	Oji	1	—	7	a.c. forward quadrant	Fujita
	Yono	1	—	2	,,	Jimura
	Omiya	6	—	25	,,	,,
Nagoya Division						
Tokaodo line	Kanaya	—	1	3	d.c. slide forward	Kyosan
	Atsuta	1	—	1	a.c. forward quadrant	Minura
	Maibara	1	—	3	a.c. and d.c. slide forward	Kyosan
Osaka Division						
Tokaido line	Kanzaki	1	—	3	a.c. forward quadrant	,,
	Ibaraki	—	1	20	a.c. slide forwzrd	,,
	Total	20	8	317		



Model A Distant Electric Signal at Yotsukaido, Sobu main line



Desk Levers in Inage Signal Cabin (Illuminated Track model and Approach Indicators are installed above the desk levers)

machine to which a circuit controller is attached. While in other yards, signals are controlled by desk levers, and the signals and the switches are electrically interlocked by attaching an electric lock to the switch lever. As a rule, the starting signals is provided with the indication and route locking, and the home signal with the indication, approach and route locking. When the change of the lines in the yard necessitated the change of interlocking appliances, the electro-mechanical interlocking machines have been adopted, having the small electric lever for the signal. In places where switch service is frequent or troublesome, electric switches have been used and the mechanical levers have been replaced by electric ones.

Manual Electric Signal.—Outside the automatic block signal territory, home made manual electric signals are used in case distant and home signals cannot be conveniently operated mechanically because of the distance.

Power Interlocking Plants.—In busy stations, power interlocking plant, compared with mechanical interlocking system, makes work easier and safety more reliable. In 1917, the d.c. electric interlocking machine of the G. R. S. Co. was installed

Years		1923	1924	1925	1926	1927	1928	1929
Track Length in K.M.		514.0	521.0	643.8	848.2	871.4	1027.6	1305.5
No. of Signals	Semaphore	417	582	615	632	577	690	518
	Color-Light			11	303	324	1266	1590

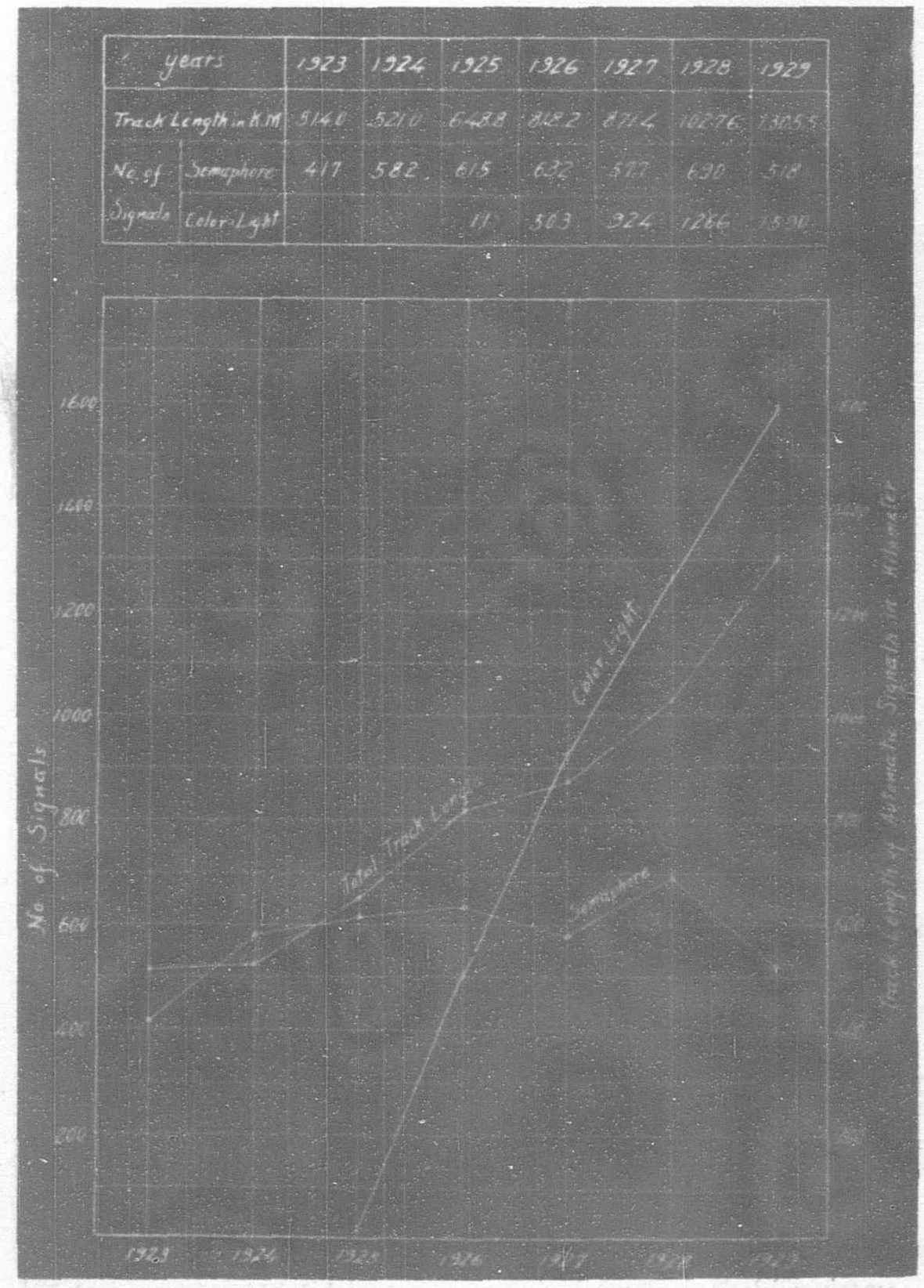


Fig. 1.—Chart showing Increase of Automatic Signals since 1923

in Maibara Station and in 1922 an a.c. electric interlocking machine of the same company was planted in Tamachi Station. The favorable result in each case led to the installation of the foreign made a.c. electric interlocking machine in Nakano, Ueno and Sakuragi-cho stations, and the home made electric interlocking machine was adopted in such stations as Akashi and Kusatsu. The electro-pneumatic interlocking apparatus is at present being tried at Shinjuku Station. Table 4 shows the installations of electric and electro-mechanical interlocking plants in service, and Table 5 shows those under construction.

Power Switch Machines.—In 1915, the electric switch machines of Siemens were installed in Kyoto for the first time, which have been followed by the installation of electric switches in busy places or in those places where it is difficult to manipulate because of the distance. In all instances, electric levers are used for electric switches and interlocked mechanically with signals levers.

Highway Crossing Protection.—As highway crossing protection, electric bells or telephones used to be provided forming communication between crossing watchmen as well as between the watchmen and

stations, warning watchmen against the approach of trains, and in case of necessity large bells were used to warn the public, but in 1921 or thereabouts automatic highway crossing signals came to be adopted. At first, the Wig-Way system was tried, but as it involved a great deal of trouble in its maintenance and operation, it was supplanted by the flash lights and alarm bell.

Power Signaling

Kinds of Signals.—The principal kinds of wayside signals of the Government Railways are Home signal, Starting signal, Block signal, Protection signal, Distant signal, Call-on signal and Shunting signal. The distant signal to the starting signal is generally called "Passing signal."

Signal Indications.—Two aspect signals for manual signaling and three aspect signals for power signaling are adopted as a rule. In order to avoid confusion of the indications of semaphore arms, the distinction between two aspect and three aspect signals is given whether by upper quadrant or lower quadrant in the daytime. And in the case of the two home signals on a common post, it is given by the relative position of the signal lights at night.

Two types of signals, semaphore and daylight, are used on the railways:—semaphore or color light for home signals, starting signals, block signals, protection signals and distant signals; semaphore, color light or position light for call-on signals; semaphore or position light for shunting signals. These signals give the following indications.

(1) *Home signal, Starting signal, Block signal and Protection signal*			
in the case of two aspect	semaphore		
stop signal (stop)			
daytime	arm horizontal		
night	red light		
proceed signal (proceed)			
daytime	arm 45 deg. downwards		
night	green light		
in the case of three aspect	semaphore		color light
stop signal (stop)			
daytime	arm horizontal	}	red light
night	red light	}	
caution signal (proceed to the next signal)			
daytime	arm 45 deg. upwards	}	orange-yellow light
night	orange-yellow light	}	
proceed signal (proceed)			
daytime	arm 90 deg. upwards	}	green light
night	green light	}	
(2) Distant signal.			
in the case of two aspect home signal	semaphore		
caution signal (proceed to the home signal)			
daytime	arm horizontal		
night	orange-yellow light		
proceed signal (proceed)			
daytime	arm 45 deg. downwards		
night	green light		
in the case of three aspect home signal	semaphore		color light
caution signal (proceed to the home signal)			
daytime	arm 45 deg. upwards	}	orange-yellow light
night	orange-yellow light	}	
proceed signal (proceed)			
daytime	arm 90 deg. upwards	}	green light
night	green light	}	
(3) Call-on signal	semaphore	color light	position light
proceed signal (proceed at low speed)			
daytime	arm 45 deg. downwards	green light	a line of white lights at 45 deg.
night	green light		
(4) Shunting signal.			
in the case of two aspect	semaphore		position light
stop signal (stop)			
daytime	arm horizontal	}	horizontal line white lights
night	red light	}	
proceed signal (proceed)			
daytime	arm 45 deg. downwards		a line of white lights at 45 deg.
night	green light		
in the case of three aspect	position light		
stop signal (stop)	horizontal line of white lights		
caution signal (proceed to the next signal)	a line of white lights at 45 deg.		
proceed signal (proceed)	vertical line of white lights.		

Shape of Signals.—Signal blades of the semaphore signals are all rectangular and in order to distinguish among them, the ends of signal blades are made in different shapes, namely—the blade of an automatic block signal has a pointed end, the distant blade has a V-shape or fish-tail end, the passing blade has a plectrum end, and the others have square ends. The front of the distant blade is painted yellow with a black stripe parallel to the end of it and the others are painted red with a white stripe near the outer end, while the backs of all blades are painted white with a black stripe near the end.

All of the color light signals are of vertical type having ordinarily the red light at the bottom, the orange light in the middle and the green light at the top. The front is painted black while the back is white.

Absolute Signal and Permissive Signal.—Home signals, starting signals and the like, and semi-automatic block signals are absolute signals and trains absolutely stop and stay when they indicate stop, while automatic block signals are permissive signals and trains stop once, and may proceed at reduced speed when they indicate stop. Distinction between both is given by making the blade of the absolute signal with square end and that of the permissive with pointed end. The night indication as to whether a signal is absolute or permissive is shown by adding a white marker light some distance below the semaphore arm or the color light in the permissive signals.

To the permissive signals used at such heavy gradient as ten thousandths or more where it is very difficult to start, a grade sign is added some distance below the arm or the light. This grade sign is of an ultramarine disc fringed white by day and a violet light by night.

All of the automatic block signals except interlocking signals have a name plate showing the location of the signals and the names of the lines on which the signals are installed. The number of signals represents not only signal location, but also the direction of traffic they govern; that is, the signals for downward trains are numbered to the nearest odd tenth of the kilometer and upward to the nearest even tenth of the kilometer.

Normal Clear and Normal Danger.—Home signals, starting signals, shunting signals, etc., indicate normally stop, distant signals indicate normally caution, while automatic block signals indicate normally proceed; and call-on signals do not indicate normally any signal. But in the automatic signaled territory we cause most of the home signals and starting signals to display clear indication normally.

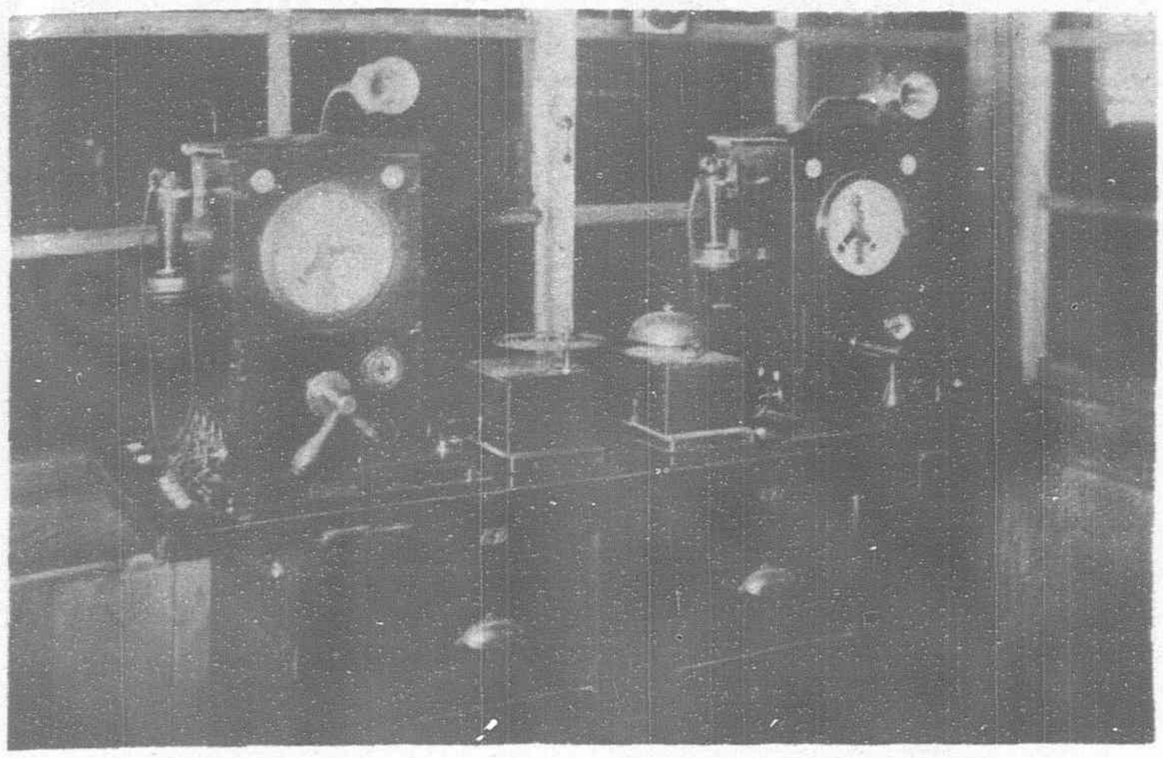
Automatic Block Signal Activities.—The steady and rapid development of automatic block signaling has been made on Government Railway as described in the previous paragraphs. In January 1929, automatic block signals were installed on 1,434.6 km. of track, of which 177.4 km. are of electric and 1,257.2 km. are of steam sections. Of the total automatic signals installed, 581 are of semaphore and 1,590 are of color light, an increase of 500 color light signals as compared with those of the previous year.

In January 1929, 41 semaphore and 398 color light signals were under construction on 321.8 km. of track length. We have furthermore 258 semaphore and 296 color light under contemplation on 192.5 km. of track length. The Tokaido main line, the longest (601.3 km.) and principal of the Government Railways, has been almost entirely automatic signaled except 111.3 km. now under construction.

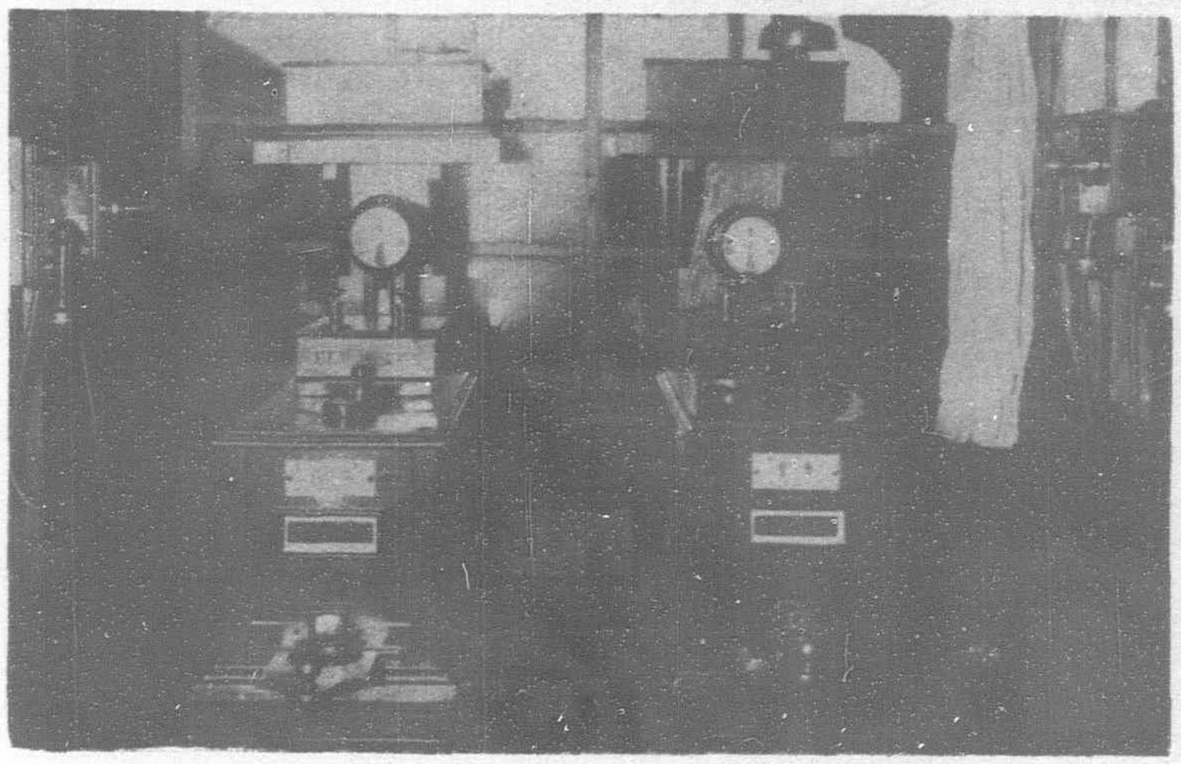
On the electric car and electric train sections round Tokyo, power signaling is utilized extensively and we have experienced satisfactory results of automatic signaling on transportation in rush hours. As a good example of the great utility of automatic signaling on electric car sections, we can cite the section between Tamachi and Ueno which is superposed with Yamate and Keihin line. Here, thirty trains consisting of five or seven bogie-cars are running is each direction per hour with a mean headway of two minutes.

We are endeavoring to increase the number of train despatches on the electric car sections by means of increasing block signals and improvement of interlocking signaling. In some stations, by the method of adding automatic call-on signals to the home and starting signals, a train is allowed to enter the section at low speed even if it is occupied. Besides, time signals automatic train stop devices are proposed to be used in the near future.

Signal Mechanism.—Two kinds of automatic signals are used; the semaphore and color light signals as described in the previous paragraphs. Semaphore signals are of U. S. S. Co.'s model T-2 and G. R. S. Co.'s model 2-A, and both operate with a.c. 110 volts. All of the color light signals except a very few, are made in Japan and there are two types, L type have the effective visible distance of 1,000 meters and N type have that of 600 meters. On the car sections of which block length is short and on which trains



"Soshin" Block Instruments at Hirai Station



Tablet Block Instruments at Chiba Station

are running at comparatively low speed, N type color light signals are used and L type on the other sections.

The lamps for the color light signal are rated at 30-volts, 40 watts. They are gas filled lamps having a double concentrated tungsten filament, and are actually supplied with 26-28-volts from the lighting transformer which has 50-volt-ampere capacity. The lamp equipments have an adjustable socket so as to set the concentrated filament accurately in the focal center of the optical system formed by two stepped lenses, the outer being clear and the inner colored. Color light signals on curve lines have a 10 deg. or 20 deg. deflecting lens outside the outer lens if necessary in order to deflect the beam to one direction.

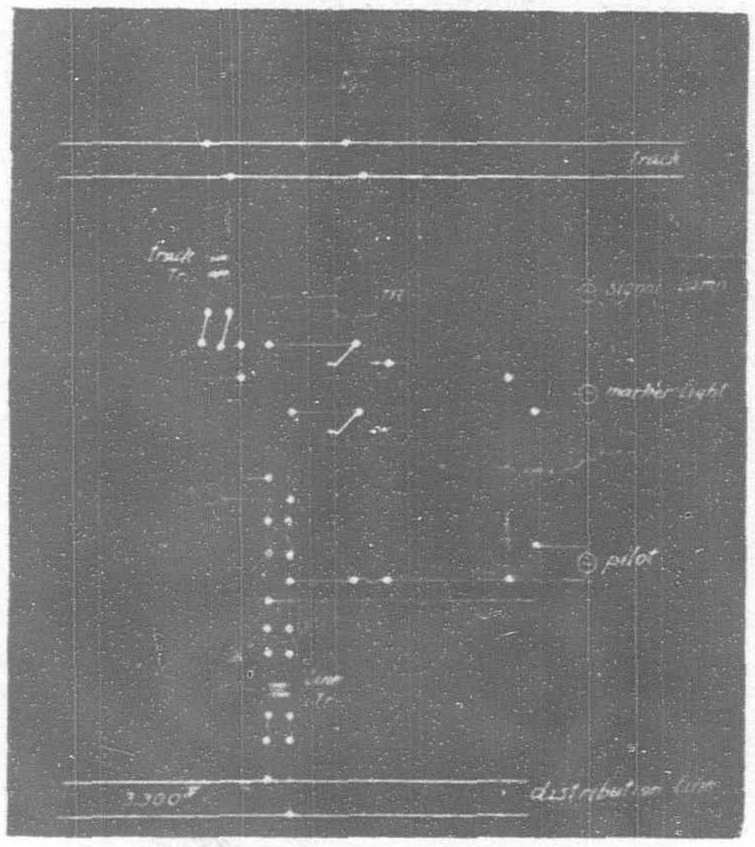


Fig. 14.—Typical Control Circuit of the Semaphore Automatic Block Signal

Track Circuiting.—Automatic signaled sections on the Government Railways are equipped with a.c. continuous track circuit which is of end feed normal close type. In the yards of some stations single rail track circuits are used, while the double rail system is in the others. In the electrified sections, impedance bonds are inserted at the insulated rail joints. There are two kinds in impedance bond, one has 1,000 amperes current capacity and the other, 500 amperes. The impedances are both 0.5 ohms at 50 cycles. Impedance bonds are provided with a secondary winding of 20 amperes current capacity, to which a track transformer or a track relay is connected so as to prevent the a.c. track circuit form direct current.

As to insulated rail joints, there are used the Keystone type, Weber type or somewhat modified ones. The bonds between the rails are all expanded-terminal ones. Two stranded soft copper wires fitting 12 mm. wire in diameter, are used on electrified lines and two hard drawn copper or steel wires with copper terminal, both of which have 4 mm. diameter are used on the steam lines. Signal wiring is generally aerial but in the yard where it is undesirable to carry aerial lines, impregnated armored cables are laid under the ground, while in cases where wires are crowded, impregnated lead covered cables are carried through concrete or creosoted wooden ducts.

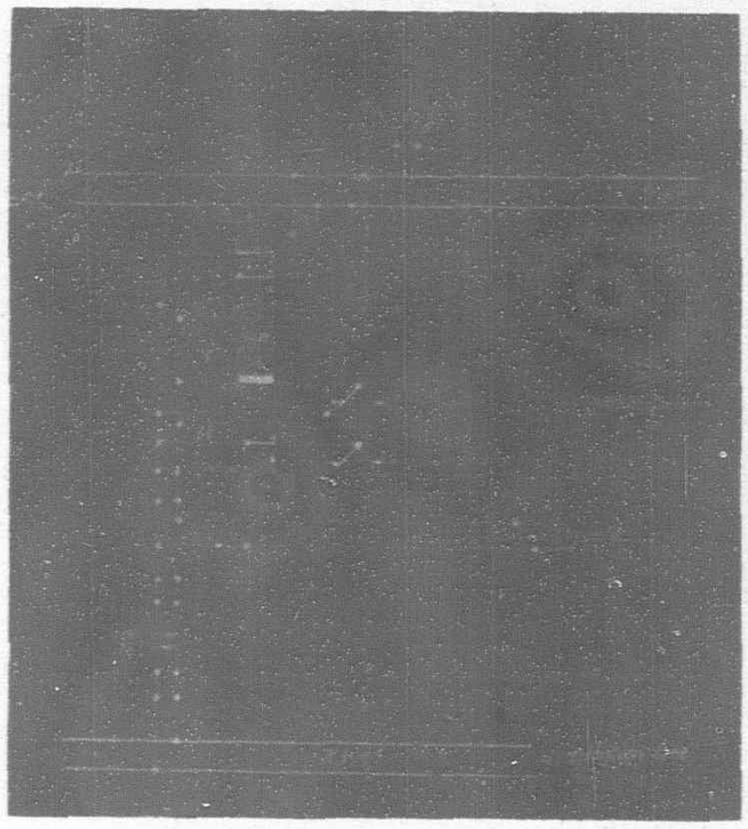


Fig. 15.—Typical Control Circuit of the Color Light Automatic Block Signal

There are two kinds of track transformer; one of them has an output of 410-volt-amperes, used on electrified lines, and the other, an output of 230-volt-amperes on steam lines. Track reactors or track resistors are connected in series as a current limiting device between the track transformer and the rail.

The a.c. track relays except a few which are of motor type, are of double element vane type. Three position relays are generally used through except two position relays in the yard. S type relays are adaptable for the steam sections and E type ones for the electrified sections. Fig. 14 shows a typical wiring diagram of automatic semaphore signals and Fig. 15 shows that of color light signals.

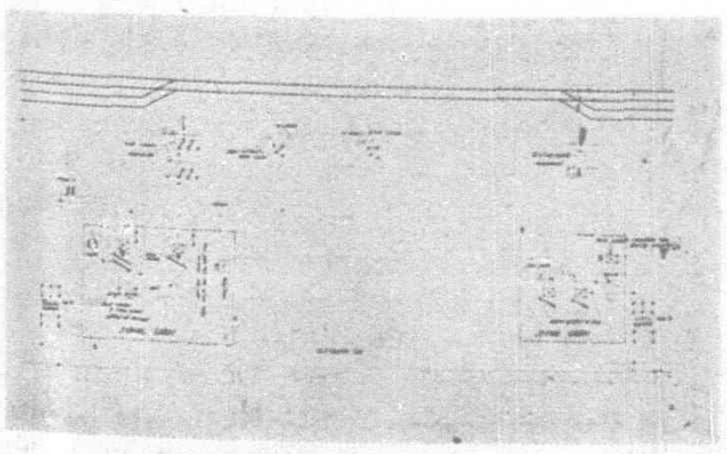


Fig. 3.—Connection Diagram showing relation between Mechanical and Automatic Signals in the station

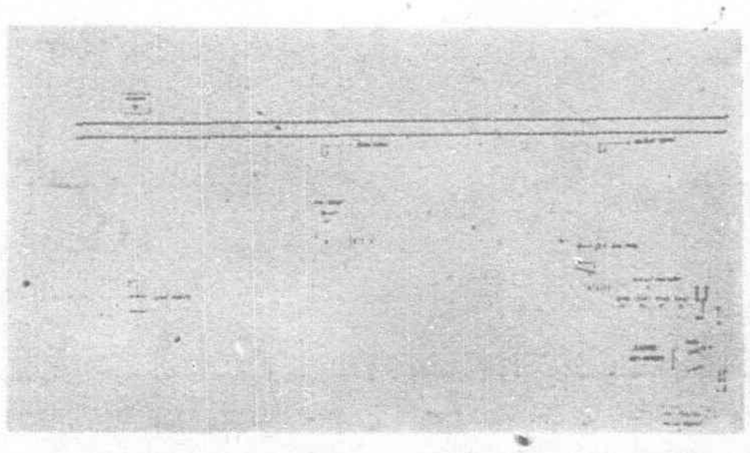


Fig. 16.—Typical Control Circuit of the Model A Electric Distant Signal

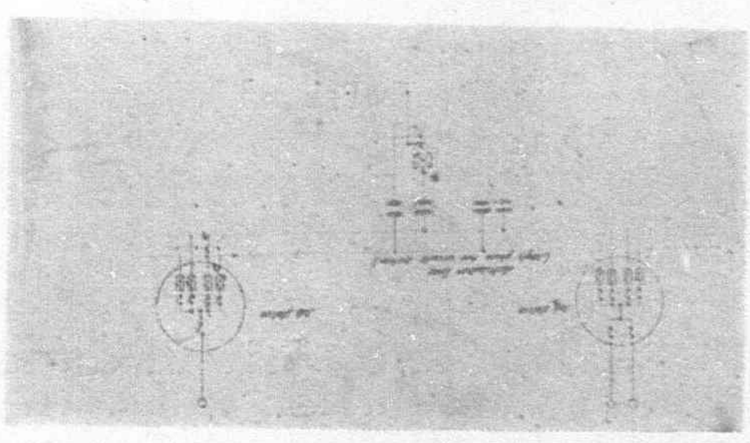
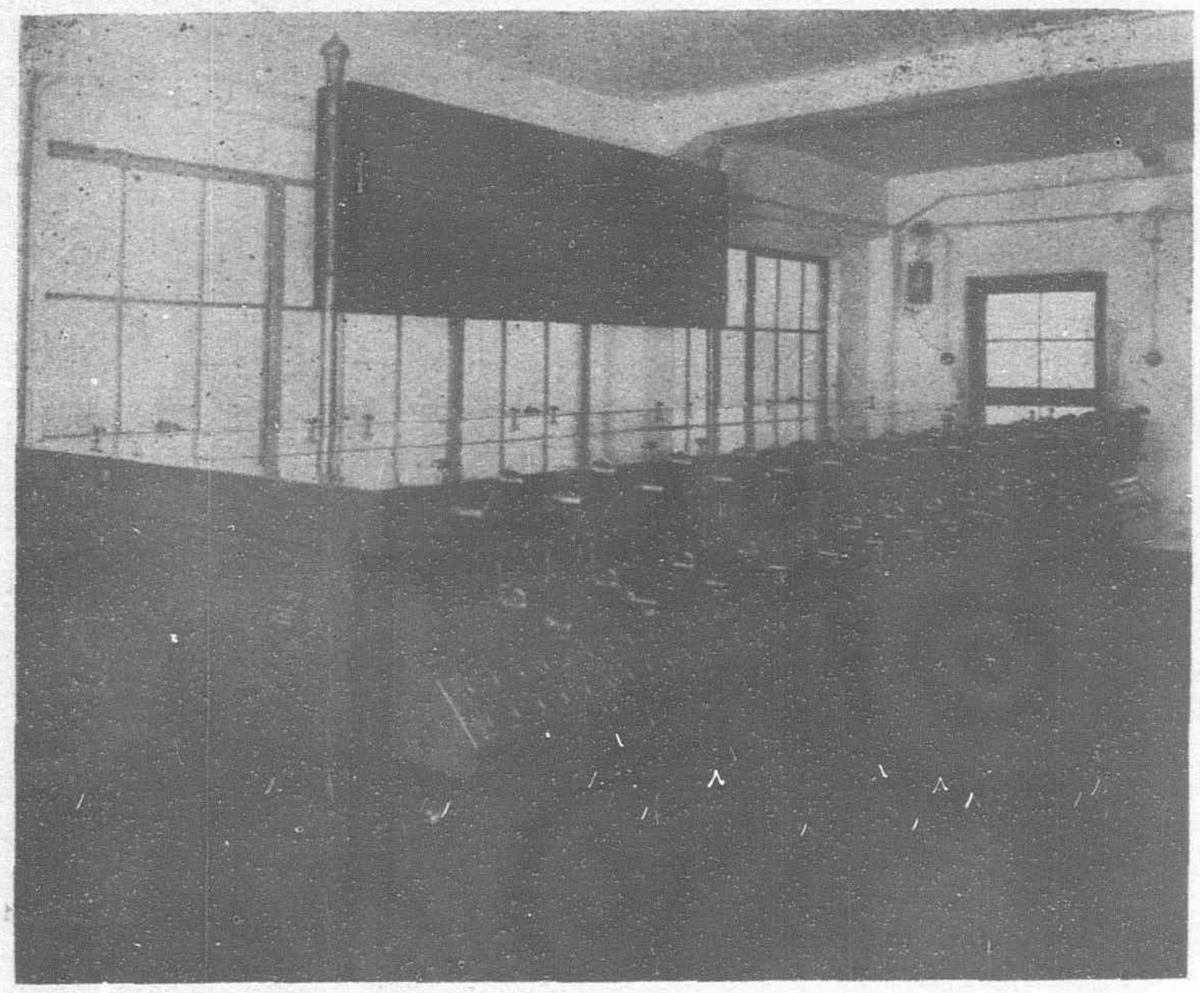
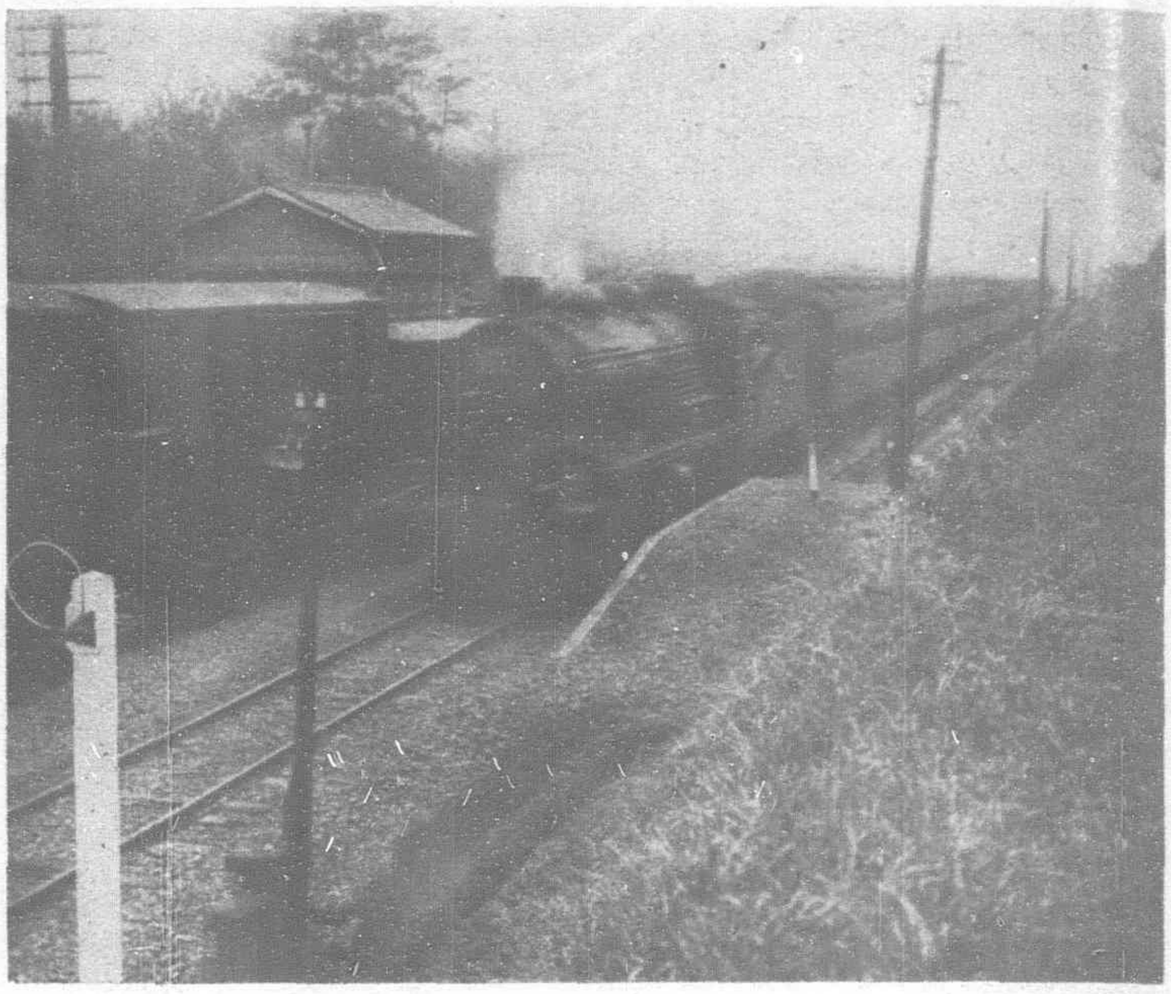


Fig. 17.—Single Phase Two Circuits Arrangement



Electro-Pneumatic Interlocking Machine in Shinjuku Signal Cabin. (this machine is manufactured in U.S.S. Co.)



Handling of the Tablet of Block Instrument during the time train is passing through the station

Annunciators and Indicators.—At the stations having two or more arrival lines for trains of different destination which come from one line in the automatic signaled sections, we have train annunciators in order to know the destination of the trains from the last station. On the electric car sections train indicators are furnished at the platform so as to give notice of approach of trains to passengers and to moderate the congestion. The train indicator automatically displays in order the name of the first or second station behind, as a train approaches. (Photo No. 3)

Owing to curved lines or other obstacles, where it is difficult to see or hear the starting order of the station master to the rear conductor, or the sign of the rear conductor to the engine man, to the platform provided with a starting order signal for the former purpose and with a starting sign for the latter, the indications being—

in the starting order signal

color light	orange-yellow light
disc	orange-yellow disc

in the starting sign

color light	green light
disc	green disc

Manual Electric Signals.—The mechanical semaphore signals in places where it is difficult to recognize the signal arm because of trolley wires, poles or other obstacles, or the driver is liable to mistake others for the real semaphore indication, are replaced by color light signals. We give as an example, Tokaido branh line between Tsurumi and Yokohamaminato (11.2 km.) which is not automatic signaled because the traffic is not so dense, but is equipped with manual color light signals, and mechanical signal levers in the section are replaced by electric desk levers for the electric signals. The mechanical signals which it is difficult to operate for reason of long distance, curves, etc., are replaced by electric semaphore signals. The color light and electric semaphore signals used in those cases, do not depend upon the track circuits but are operated manually.

The electric sempahore signal, model A, being designed in the Department of Railways, is of d.c. series motor type and is supplied with 9-volts. (Photo No. 4). The signal arm is motered in five seconds from 0 to 45 deg. downwards with about 2.5 amperes for starting, and about 20 milliamperes for holding. Fig. 16 shows typical wiring diagram of a model A electric signal for a distant signal.

As shown in this figure, when the lever of the home signal (mechanical) is reversed, the signal arm contact makes the d.c. line relay circuit and causes the arm of the distant signal to operate downards 45 deg. In order to indicate whether the distant signal is operated or not, a signal repeater is set at the station.

Distribution Line.—The distribution line for automatic signaling has been constructed for exclusive use. The distribution system is now of three phase single circuit, but we intend to adopt the system of single phase double circuit. The former system has an advantage of balancing loads, decreasing the voltage drop and power losses in a distribution line, whereas it has a tendency to trouble maintainers because of variety of relative phase between the local and the track coils of double element track relays. The power required for operating automatic signals being comparatively small, we prefer the single phase system. And besides, in order to avoid the interruption of power supply due to the maintenance or repair of distribution lines or other circumstances, we intend to make it double circuit.

The distribution voltage is 3,300-volts and it is reduced to 110-volts by means of a line transformer. The frequency is either 50 or 60 cycles.

As a rule aerial lines are used for power distribution, but in tunnels, and where they are not available because of the difficulty of erecting poles or towers, underground cables are used. A section oil switch is equipped at every some five kilometers, if possible at a station, to cut off the section and to limit the unfeeded portion as small as possible when power failure occurs because of

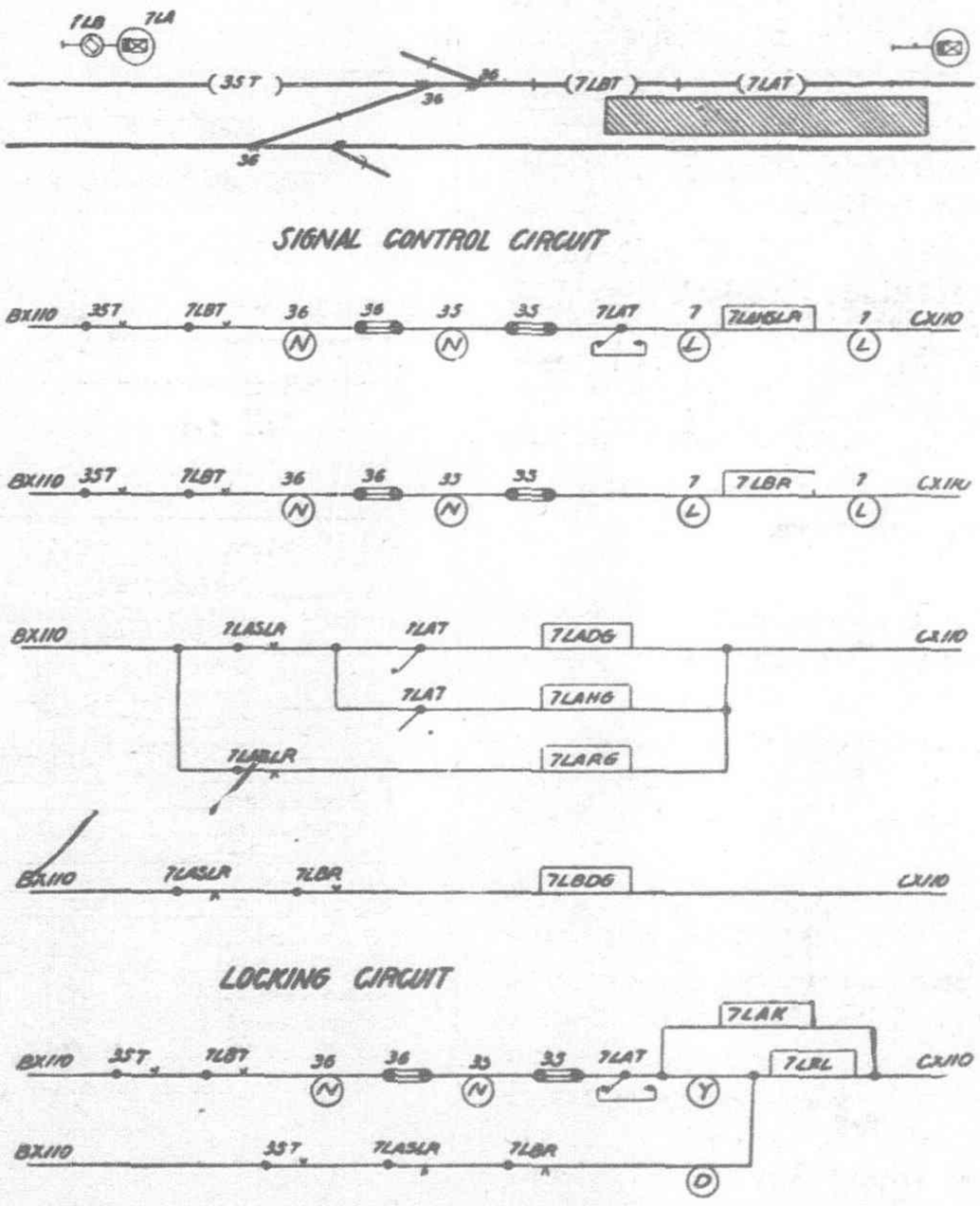


Fig. 13.—Control Circuits of Power Signals with Automatic Call-on Signal

earthing or snap. It is also applicable during inevitable stoppage of power supply owing to line construction, cleaning of insulators or other circumstances. Aerial distribution lines are provided with autovalve or pellet type oxide-film arresters as well as a ground wire all along to protect against lightning.

Protection against Power Failure.—Various means have been devised to protect against power failures. We have a few private coaling power stations for automatic signaling, but as a rule the power is purchased from commercial power supply companies. Substations are adapted to receive power from as different sources as possible.

Each substation has switch boards exclusively used for automatic signaling, and at important substations automatic switching device is installed (Photo No. 5) which function in not more than one second, and therefore, when one station would fail or the voltage go down under the pointed voltage or any troubles occur in

Highway Crossing Flash Light Signals at Nagasu Highway Crossing between Chiba and Soga

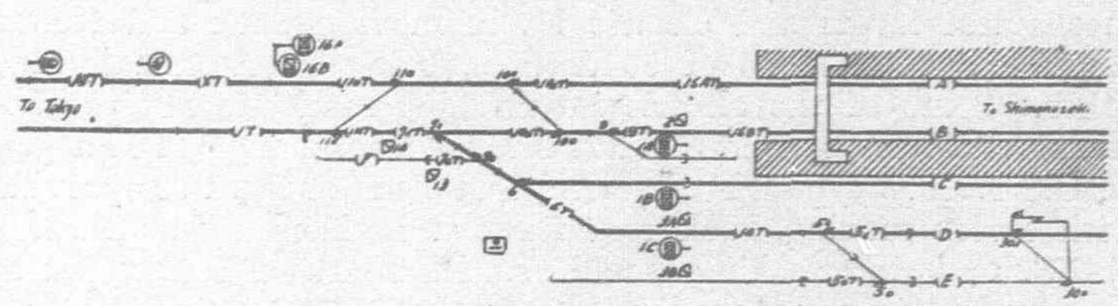
the distribution line, the automatic equipment will act in an instant and power supply will be continued from the other station or from both sides. There is established one substation every, 30 to 50 kilometers. If the two adjacent substations fail at the same time, power supply will be extended from the next substation by means of hand operated switches. Thus any accidental power failures will be entirely prevented.

In newly installed sections, as previously described, single phase double circuit system is adopted for an intentional stoppage of power supply. In this system each circuit is provided with a line transformer for every block signal. Normally both circuits are kept charged, and when the loaded circuit is interrupted either accidentally or intentionally, the power for an automatic signal is derived from the other distribution line automatically. In the case that both distribution lines are snapped down at the same time power may be supplied from both substations. These are illustrated in Fig. 17 and Fig. 18.

Some of the substations are equipped with an automatic voltage regulator of induction type on their receiving side to keep the line voltage always constant at 3,300-volts while the receiving voltage is within the limit of 2,800 to 3,500-volts.

Line Transformers.—Line transformers for automatic signaling have 3,300-volt primary and 110-55-volt secondary. They are provided with primary terminal blocks which have 3,000, 3,150,

LOCKING SHEET OF AKASHI (TO TOKYO) STATION
THE FIRST CLASS ELECTRIC INTERLOCKING PLANT

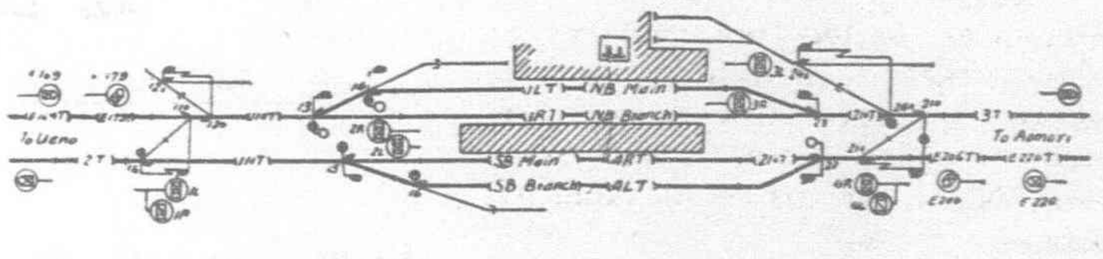


Name		No	When	Lock	Control of Detector Lock	Route Locking Section	Approach Locking Section	Route
Starting Signal	B — To Tokyo	1 A	7	7 ⑦ 11 14 2	9T and 2T,14T,9 or ⑦ 11	9T 10T		9 10 ⑦ 11
	C —	1 B	7 ⑥	6 ⑥ 3	6T 7T 2T,14T 1T 6 7 11	6T 7T		6 7 11
	D —	1 C	⑦	5 [30] 10 9	6T 7T 7T 11 6T 1T ⑥ 7	6T 7T		5 ⑥ 7 11 [30]
Standing Signal	B — 11T	2		9 10 ⑦ 11 14 1	9 10 ⑦ 11	9T 10T		9 10 ⑦ 11
Shunting Signal	C — 11T	3 A	7	6 ⑥ 7 ⑦ 11 14 1	6 7 11	6T		6 7 11
	C — F				6 ⑦	6T		6 ⑦
	D — 11T	3 B	⑦	13	⑥ 7 5 11 [30] or ⑳	6T		6 7 11 5 [30] or ⑳
	D — F		⑥	5 ⑤ [30] [30]	⑥ ⑦ 5 [30] or ⑳	6T		⑥ ⑦ 5 [30] or ⑳
	E — 11T				⑥ 7 ⑤ 11 [30]	6T		[30] ⑤ ⑥ 7 11
	E — F				⑥ ⑦ ⑤	6T		[30] ⑤ ⑥ ⑦
Spare		4						
Double Switch		5		[101] [30]	5.7 5.7 [30] [101]			
Single Switch		6			6T			
Double Switch		7			7.T 7.T			
Spare		8						
Single Switch		9			9T			
Double Switch		10		11	10.T 10.T			
Double Switch		11		10	11.T 11T 11.T also 11)			
Spare		12						
Shunting Signal	F — C	13	6	6 ⑥ ⑦ 3 V91	6 ⑦ V91	7.T 6T		⑦ 6
	· — D				⑥ ⑦ V81 [30] or ⑳	7.T 6T 14T		⑦ 6 5 [30] or ⑳
	· — E		⑥	5 ⑤ [30] ⑳ V81	⑥ ⑦ 5 V81 [30]	7.T 6T 14T		⑦ 6 ⑤ [30]
Shunting Signal	11T — B	14	7 6	7 ⑦ 11 1 6 ⑥ 3 (19)	⑦ 9 10 11	(7T 11.T) (9T)		11 ⑦ 10 9
	· — C				7 6 11 V91	(7T 7.T)		11 7 6
	· — D		7 ⑥	5 ⑤ [30] ⑳ V81	7 ⑥ 5 11 [30] or ⑳ V81	(7T 7.T 11 6T)		11 7 ⑥ 5 [30] or ⑳
	· — E		⑦	10 9 2	7 ⑥ ⑤ 11 [30] V81	(7T 7T X 6T)		11 7 ⑥ ⑤ [30]
Spare		15						
Home Signal	To Tokyo — 16AT	16 A		10 ⑩ 11	11T 10T 14T 10 11	11.T	2T ART	11 10
	— 16BT	16 B	⑩	9	10T 10T 10T 9T 16BT ⑩ 11 9	11.T 10T 10T		11 ⑩ 9

Note — ( ) In the colume of Lock denotes other Signal Cabine
[ ] In the colume of "Lock or Route" denotes double switch with Electric Switch Lock
( ) In the colume of "Route Lock Section" denotes Section Route Lock

Fig. 19.—A sample of Locking Sheet for the First Class Electric Interlocking Plant

LOCKING SHEET OF WARABI STATION
THE SECOND CLASS ELECTRIC INTERLOCKING PLANT



Name		No	Lock	Control of Detector Lock	Route Locking Section	Approach Locking Section
Home Signal	To Ueno — NB Main	1 L	11 12 13 14	11.T 1LT	11.T	E169T E179T
	To Ueno — NB Branch	1 R	11 ⑬ 12	11.T 1RT	11.T	
Starting Signal	SB Branch — To Asaka	2 L	11 ⑮	11.T 2T 16	11.T	
	SB Main — To Asaka	2 R	11 15	11.T 2T	11.T	
Starting Signal	NB Main — To Asaka	3 L	21 23 24	21.T 3T	21.T	
	NB Branch — To Asaka	3 R	21 ㉓ 24	21.T 3T	21.T	
Home Signal	To Asaka — SB Branch	4 L	21 ㉒	21.T 4LT 16	21.T	E206T E220T
	To Asaka — SB Main	4 R	21 22	21.T 4RT	21.T	
Double Switch		11				
Double Switch		12				
Single Switch		13				
Single Switch		14				
Single Switch		15				
Single Switch		16	2L 4L			
Double Switch		21				
Single Switch		22				
Single Switch		23				
Double Switch		24				

Note — ○ In the colume of "Number" denotes Electric Levers
⌣ In the colume of "Lock" denotes Partial Lock

Fig. 20.—A sample of Locking Sheet for the Second Class Electric Interlocking Plant

3,300 and 3,450-volt taps for the voltage change in distribution lines. In order to protect the low tension side from high tension, line transformers have a sheet of copper inserted between the two windings as an earthing device.

Interlocking Plant

Interlocking Machines.—The interlocking machines used on Government Railways are mechanical, electro-mechanical and electric. Most of the mechanical interlocking machines are of Saxby and Farmer type or Johnson type. Electro-mechanical interlocking machines are all of home make, and are provided with mechanical levers and electric levers moving back and forward through a total angle of 60 degrees, being interlocked by each other. Some of the electric interlocking machines are provided with levers turning right and left through a total angle of 60 degrees as U.S.S. Co.'s type "F" system, and some of them are provided with levers moving back and forward horizontally as those of G.R.S. Co.'s interlocking machines. Machines of both types are now made lately in Japan. (Photos No. 6, 7, 8, 9 and 10.)

In large and busy stations the interlocking machines are installed at the signal cabins, while in other stations simpler interlocking boxes or electric locks are provided over yards to interlock signals and switches. When simple interlocking boxes are used it is done by means of mechanical interlocking between the operating wire of a signal and a switch, while in the case of electric locks, by means of electric interlocking between the electric locks attached to mechanical switch levers and the desk levers of signals.

Such plants as mechanical, electro-mechanical or electric interlocking machines are installed at signal cabins, are called the First Class Interlocking Plant, and the others the Second Class Interlocking Plant, on the Government Railways.

Electric Locking.—In automatic signaling sections, home signals are equipped with approach, route and indication locking; starting signals and shunting signals with route and indication locking; switches with detector and indication locking; and sectional route locking is added to switches in frequent service.

In approach locking, since a train has entered the second section (first section in electric car sections) outside of the home signal which has accepted the train, the signal lever is so locked that it cannot be restored to its full normal position unless the train has entered the section governed by the home signal or the time release in the cabin is taken advantage of. Approach locking is mostly controlled by a stick relay. Route locking in an arrangement whereby a signal lever is locked not to be restored to its full normal position by the arrival of a train at the signal until the train has passed all switches and derails within the limit of the route entered. Sectional route locking is applied to switch levers; and as soon as each section is cleared by a train, the locks in that section are released. In indication locking a signal lever cannot be restored to its full normal position until the indication is received that the signal has gone to the stop position; a switch lever is locked not to be returned to its full normal or reverse position until the switch point has been perfectly thrown and locked in its proper position. This is accomplished by means of the battery indication system except in the G.R.S. interlocking machines.

Signal levers of mechanical and electro-mechanical interlocking machines can be reversed at any time if the mechanical interlocking allows, as they are not provided with normal lock. The other signal levers which are not mechanically interlocked such as desk levers, are equipped with normal lock, and therefore, cannot be reversed unless the electrical release should be properly given.

Power Switch Movements.—Switches in heavy service or hard operation because of distance, have been equipped with electric switch and lock movements year by year. The movements in automatic signaled sections are generally operated by a.c. 110-volts, while in the other sections by d.c. 110-volts in heavy service. The d.c. 20-volts machine is operated at low speed in light service. When a switch and lock movement is applied to a switch, the mechanical interlocking machine is modified into the electro-mechanical, the mechanical switch lever being changed into electric.

Each switch machine is provided with a lock; and all the Japanese manufactures are of G.R.S. type equipped with battery indication system instead of dynamic. Most of the switches are provided with electrical detector locking or mechanical detector bars, furthermore, shunting signals are installed as far as possible to prevent the switch levers from improper manipulation.

Shunting Signals.—Dwarf signals of position light type are used for shunting, which display a line of two white lights, and as a rule they work in two ways or in two positions, having no connection with track circuits. Sometimes three position shunting signals are used which are controlled through track circuits. Shunting signals are equipped with route and indication locking. We install but one signal for various routes except the special case demands one for each route.

Locking Sheets.—In our Government Railways such a locking sheet is used to express the interlocking condition at yards as shown herewith.

Fig. 19 shows an example of the First Class Interlocking Plant, and Fig. 20 the Second Class Interlocking Plant.

Block System

Manual Block System on Double Track.—All through on double tracks, excepting the automatic block sections, the Soshin block system has been adopted. The Soshin block instrument used for this system was devised in Japan. (Photo No. 11) Two of these instruments form a set, and are jointly used on both upper and lower lines. This instrument is worked by d.c. 6-volts, and consists of a bell and telephone for communication, red and green colored arms and a handle for changing the direction of the electric current in the opposite station. The red colored arm takes two positions, horizontal and 45° downwards according to the direction of the electric current from the opposite station. The green colored arm is operated mechanically in two ways by the handle of its own station, thus controlling the red colored arm of the opposite station. Fig. 21 shows these connections.

Automatic Block System on Double Track.—In adopting the automatic block system, automatic block signals are installed at convenient intervals, 1.5 to 2.0 kilometers apart, between stations. But in order to secure smooth operation, a distance of about 0.85 kilometer is kept between the home signal and the first signal behind and about 1.20 kilometers between the starting signal and the first signal in front. However in such places as the Chuo, Yamate and Keihin lines where electric cars are running the automatic signals are installed at a distance of 0.4 to 0.5 kilometer, in order to despatch cars in short intervals. In automatic block sections, trains are operated simply by the signal indications and the time table, and not by train despatchers or other block instruments.

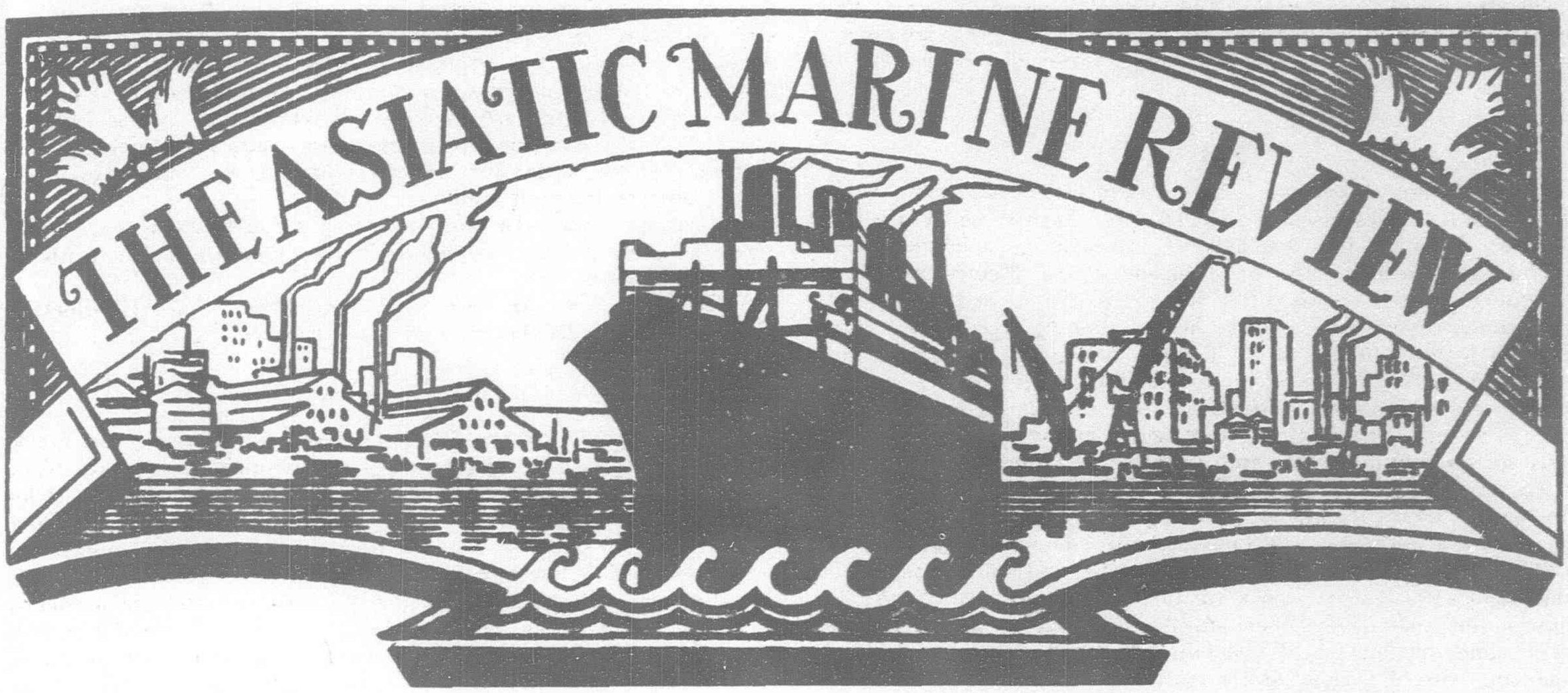
Manual Block System on Single Track.—On single track sections, the tablet block system is mostly used. Several improvements have been made upon Tyer's Tablet Block instruments by our Railway Department, and these improved instruments are made in Japan. Tablets are generally of four kinds, but in special cases, several other kinds are introduced. There are equipped tablet catchers on the platform for receiving a tablet from a moving train or for holding a tablet so that it can be picked up by a moving train. (Photos No. 12 and 13) Connections of tablet block instruments are shown in Fig. 22.

Herewith are given some of the special devices for the tablet block system. In places where a boosting engine is to go back on the way, the tablet is carried by the driver in charge, and the driver of the boosting engine takes with him the key to lock the block instrument. In this case, it is so arranged that only at the time when the key is placed in the block instrument, the electric block circuit is made as in the normal state, and when the key is taken out, the circuit is broken. Therefore, until the driver of the boosting engine puts the key back, the block instruments on both sides do not regain normal state.

In cases when there are freight lines branching off in the block sections, a special key arrangement is made on the switch so that in case trains are brought in or out of shuntings, the conductor can unlock the switch by the tablet for that section only. Again, in the station where trains cannot pass each other there are provided special contacts on the lower sliders of the tablet block instruments so as to interconnect electrically both in the station, so that they shall not be in half open position simultaneously.

The other special device is that several block sections are closed into one block section. In the night hours when there is no necessity of stopping trains in the intermediate stations, several intermediate stations are blocked in one block section. In this case, in terminus stations, there is provided a special block instrument for this purpose, in addition to the ordinary ones. All the

(Continued on page 519)



New Motor Ship for Far East

On Tuesday, June 16, 1931, the passenger and cargo motor-ship *Muinam* left the yards of the builders, Messrs. Nakskov Skibsværft, for Copenhagen. The trials were carried out on the voyage to Copenhagen.

The vessel is intended for the East Asiatic Company's regular trade between Bangkok and Hongkong, and the design of the ship is carried out to fulfil the special requirements of this trade, with accommodation for 12 first class passengers, 22 second class and about 1,200 third class passengers.

The vessel is built to the highest class of Lloyd's Register of Shipping as open shelterdecker with forecastle and bridge and with houses amidships and aft.

The principal dimensions are :

Length	346-ft. 6-in.
Breadth moulded ...	48-ft. 9-in.
Depth to Awningdeck... ...	29-ft. 0-in.
Carrying capacity ...	abt. 3,500 tons d.w.

The ship is built with four hatches, three masts and two derrick-posts, with altogether 11 derricks, eight of which can lift five tons, two 3-tons and one 20-tons, 10 electrical winches are fitted, two of which can lift five tons, six 3-tons and two-1½ tons, two electrical five tons capstans aft and an electric windlass. All these are supplied by Messrs. Thomas B. Thrige, Odense, Denmark. The electrical steering gear is also supplied by Messrs. Thomas B. Thrige, Odense.

On the 'tween-deck two 1½-tons electrical cranes are fitted.

The propelling machinery consists of two deisel motors of Burmeister and Wain's make, capable of indicating 3,000 h.p. which will give the ship a speed of 13 knots loaded.

The auxiliary machinery embodies three motors, each 2-cyl. 100 b.h.p. These auxiliary motors are supplied by Messrs. Holeby Diesel-motor Fabrik, Holeby, Denmark. Each motor drives a dynamo of 65 kw.

The accommodation for the first class passengers consists of six state rooms capable of accommodating two passengers each. All the state rooms are exceptionally large and airy and specially furnished for tropical trade.

In the foremost deckhouse on the bridge-deck is situated the dining-saloon for first class accommodating 18 persons. The saloon is fitted with bulkheads and furniture in polished mahogany and is with its large square windows an exceptionally airy and pleasant room.

In the forepart of the bridge-deck is situated the dining-saloon for second class, fitted up in dark polished oak, and 11 cabins for second class passengers, each cabin accommodating two persons.

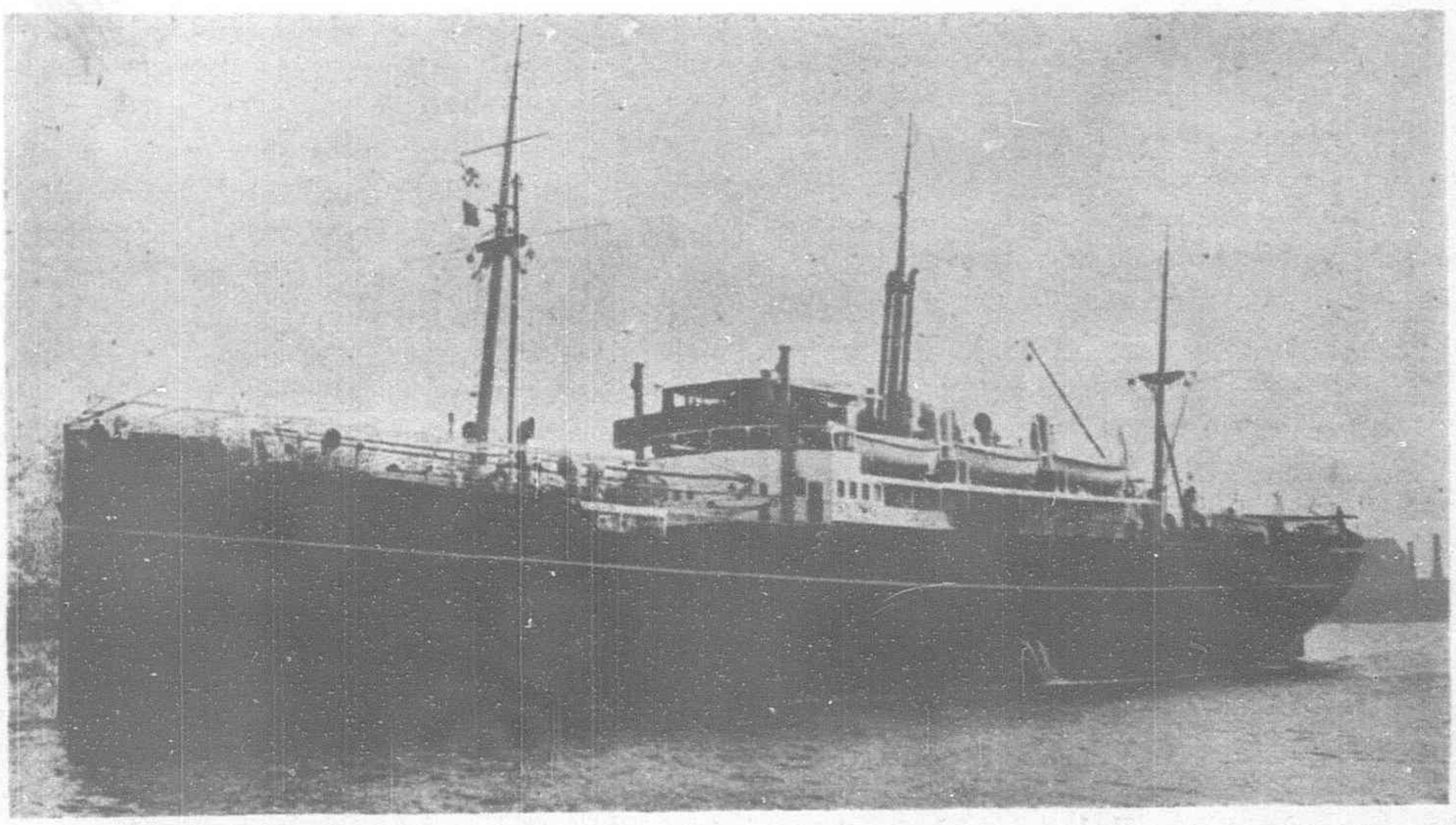
The floors in all first class saloons and state rooms are covered by the Korkoid Flooring supplied by Messrs. Rowan and Boden, Ltd., Glasgow.

The cooling chambers for the ship's provision are very roomy. The machines for same being supplied by "Atlas" Ltd., Copenhagen. Further a large Frigidaire ice box is arranged in the saloon pantry.

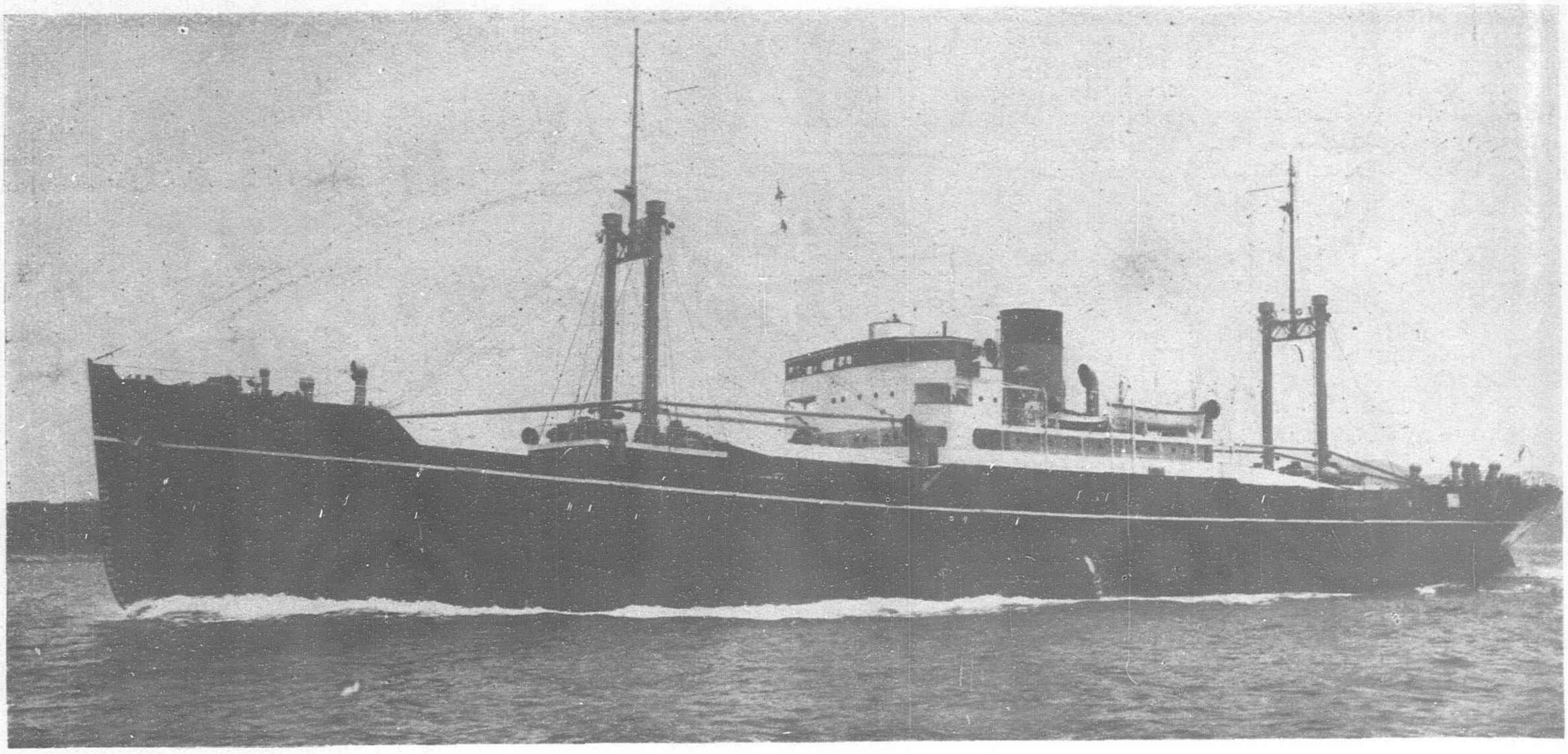
The life-boats are placed under Welin Davits of the latest pattern.

The ship is equipped with a wireless station and a wireless sounding apparatus both supplied by A/S Elektromekano, Copenhagen.

After the trial trip the ship was taken over by Messrs. The East Asiatic Company.



Motor Ship "Muinam"



The Motor Vessel "Kanan Maru"

The Dairen Steamship Company's Motor Vessel "Kanan Maru"

THE *Kanan Maru* is a wholly up-to-date Diesel driven cargo boat, having been designed on the basis of long years of experience in Chinese coastal navigation of the Dairen Steamship Company, and is the first of two similar vessels ordered from the Nagasaki Shipyard & Engine Works of the Mitsubishi Shipbuilding & Engineering Company, Limited. The keel of the vessel was laid on November 5, 1930, and she was launched on March 20 this year. She was completed on May 30, and is now at the time of writing on her maiden voyage.

The leading particulars of the vessel are as follows :—

Length overall	350-ft. 7-in.
Length between perpendiculars	335-ft. 0-in.
Breadth moulded	48-ft. 6-in.
Depth ,, ...	24-ft. 0-in.
Draught fully loaded	20-ft. 0-in.
Gross tonnage	3,280
Deadweight, tons	4,900
Speed at trials	12.686 knots

Main engine :—One set Sulzer single-acting 2-stroke '4S.60' type Diesel engine.

B.H.P.	1,500

The vessel was constructed under the special survey of the Marine Affairs Bureau of the Kwantung Government, in accordance with Teishinsho Regulations for first-class vessels, and also under Lloyd's special survey and classed 100 A.1. and L.M.C. The *Kanan Maru* is a single decker and the upper deck is surmounted by a forecastle, a bridge and a poop. On the bridge there is a boat deck, and amidship she has a partial second deck. Of schooner type, with twin upright masts and one big funnel, the vessel, as will be seen from the photograph produced, is of well-proportioned appearance.

The propelling machinery is located amidships, and there are four cargo holds, Nos. 1 and 2 forward and Nos. 3 and 4 aft of the machinery space. On the No. 2 and No. 3 holds, the second deck is worked, which provides deck cargo space and mixed living room for coolies and emigrants. The vessel has a cellular double bottom extending for the full length between the peak bulkheads, except in the way of wing tanks and tunnel well. The space right below the engine room and its after part is appropriated for the storing of feed water and fuel oil, and other parts for ballast tank.

At the fore end of the boat deck are arranged the captain's room, wireless office and the second mate's room. Above these rooms is worked the flying bridge, where the wheel house and chart room are located, fitted with a standard compass on the roof. On the boat deck are two life-boats, one "temma" a motor room for wireless telegraphy and boxes for the storing of vegetables.

The deck house on the bridge is mainly given over to the living quarters of the officers. In the center of the fore end a dining saloon is arranged, and on each side of it, one first class state room is situated. Each state room contains two berths and one sofa, thus providing accommodation for six passengers. A mess room for the officers and engineers, galley, baths, lavatories, pantry and provision storeroom are also provided.

Space below the bridge deck is all given over to the crew, and besides living rooms, baths, lavatories and galley for both deck and engine room crews as well as waiters, similar provisions exist for compradors. There is also a large provision room below the bridge deck. Underneath the fore and aft winch platforms are entrances, lavatories for emigrants and lighting sets, store, boatswain's store, and electric provision store. Below the poop deck there are the steering engine room, also coal store (for cooking purposes), rice store, ice room, paint store and boatswain's store. A luggage room, with a boatswain's store at the fore end, is situated below the forecastle. Officers' and crews' quarters are most comfortably arranged, allowing of the admittance of the maximum amount of light with perfect ventilation. As regards the fittings in these rooms, they are so complete that very few vessels of this type can compare with them.

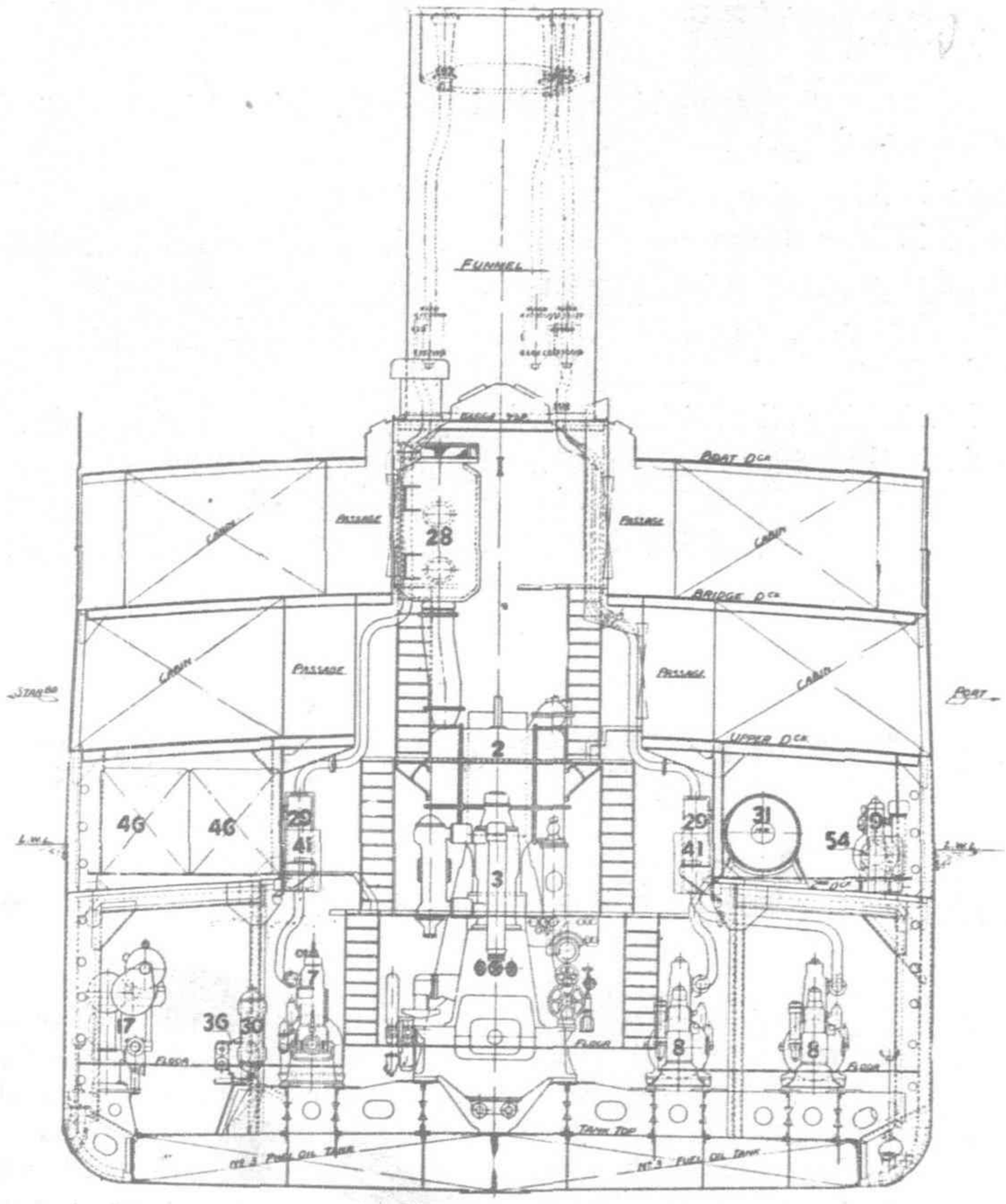
In regard to cargo handling appliances, four large hatch-ways are arranged on the upper deck, which are served by eight winches and eight derricks. The winches are Mitsubishi electric standard type, fitted with load discriminaters and each has a capacity of three tons at a speed of 100 feet per minute. The derricks are all

of Mannesman solid drawn steel tubes, mounted on four derrick-posts. Those at No. 2 hatchway, have a capacity of six tons and the other three tons each. In addition, one winch is fitted on the poop deck for mooring purposes. The windlass is a 50 h.p. electric winch, furnished by the Harima Shipyard, while the steering gear is of Messrs. Brown Brothers (England) make, and is of 10 h.p. electro-hydraulic two-ram type. The rudder and stern post is of the patented Contra system, which greatly adds to the hull efficiency in propulsion.

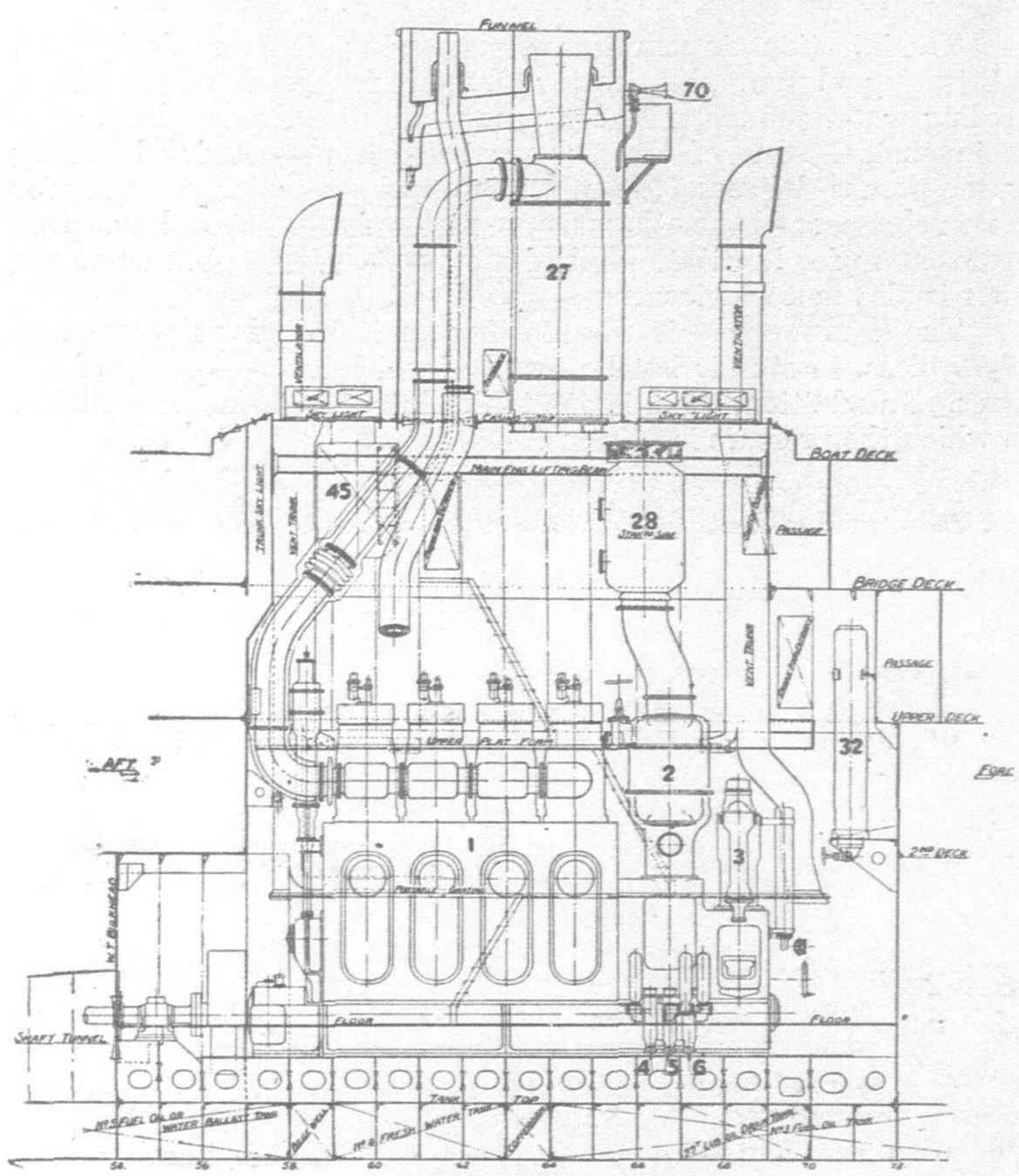
Propelling Machinery

The *Kanan Maru* is propelled by one single-acting, two-stroke cycle, air-injection four cylinder engine, supplied by Messrs. Sulzer

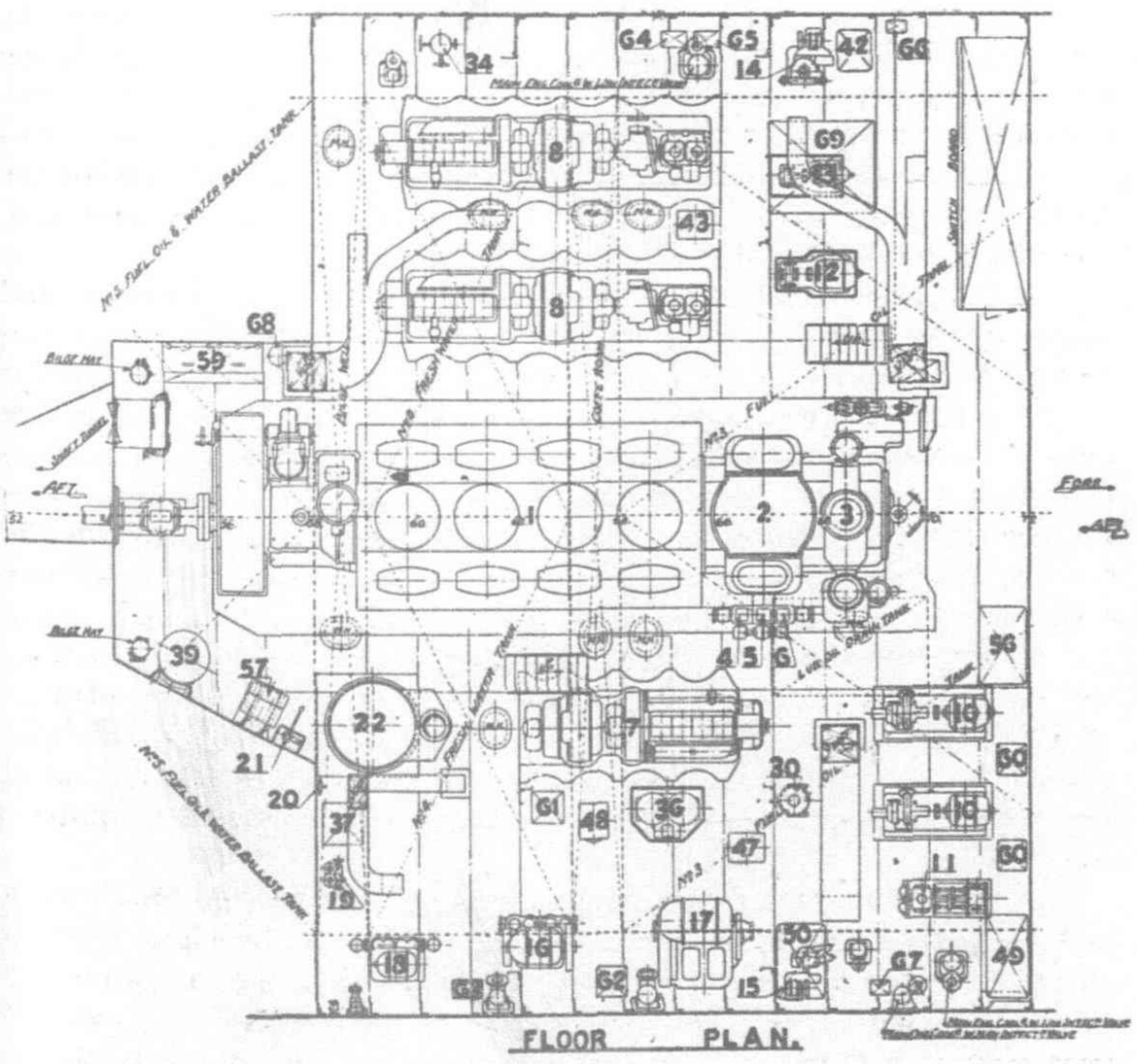
MACHINERY ARRANGEMENT OF THE "KANAN MARU"



SECTION AT F. Nº 67.
LOOKING AFT.



LOOKING PORT SIDE.



FLOOR PLAN.

MARK	SET	DESCRIPTION	MARK	SET	DESCRIPTION
1	1	MAIN ENGINE	34	1	STARTING AIR BOTTLE FOR DYN. ENG.
2	1	M.E. DRIVEN SCAVENGING AIR PUMP	36	1	LUB. OIL FILTER
3	1	M.E. DRIVEN MAIN AIR COMPRESSOR	37	1	FEED WATER FILTER
4	1	M.E. DRIVEN LUB. OIL PUMP	39	1	F.O. SETTLING TANK FOR DONKEY BOILER
5	1	M.E. DRIVEN P.C. WATER PUMP	41	2	F.O. MEASURING TANK FOR DIESEL DYN.
6	1	DITTO	42	1	FUEL OIL RESIDUE TANK
7	1	DIESEL DYNAMO ENGINE	43	1	FUEL OIL WASTE TANK
8	2	DIESEL DYN. WITH AUX. AIR COMP.	45	1	LUB. OIL HEAD TANK
9	1	EMERGENCY AIR COMPRESSOR	46	2	LUB. OIL RESERVE TANK
10	2	JACKET & PISTON COOLING WATER PUMP	47	1	LUB. OIL RESIDUE TANK
11	1	LUB. OIL PUMP (SPARE)	48	1	LUB. OIL WASTE TANK
12	1	FUEL OIL TRANSFER PUMP	49	1	DIESEL DYN. ENG. LUB. O. SETTLING TANK
13	1	FUEL OIL SERVICE PUMP	50	1	CLEANED LUB. OIL TANK
14	1	FUEL OIL PURIFIER	54	1	GREASE TANK
15	1	LUB. OIL PURIFIER	56	1	WARMING TANK
16	1	BILGE PUMP	57	1	OBSERVATION TANK
17	1	BALLAST PUMP	59	1	PISTON COOLING WATER COLLECTING TANK
18	1	FRESH W. & SANITARY PUMP	60	2	STARTER FOR JACKET & PISTON C. W. PUMP
19	1	FEED PUMP	61	1	STARTER FOR BILGE PUMP
20	1	FEED INJECTOR	62	1	STARTER FOR BALLAST PUMP
21	1	HAND PUMP FOR THE LIGHTING UP BURNER	63	1	STARTER FOR FRESH W. & SANITARY PUMP
22	1	DONKEY BOILER	64	1	STARTER FOR F.O. TRANSFER PUMP
27	1	MAIN SILENCER	65	1	STARTER FOR F.O. SERVICE PUMP
28	1	SCAVENGE AIR SLIC. SILENCER	66	1	STARTER FOR F.O. PURIFIER
29	3	SILENCER FOR DYN. ENGINE	67	1	STARTER FOR L.O PURIFIER
30	1	LUB. OIL COOLER	68	1	STARTER FOR M.E TURNING MOTOR
31	1	LOW PRESSURE AIR TANK	69	1	CLEANED F.O. TANK
32	5	STORAGE AIR BOTTLE	70	1	AIR HORN

Brothers, Winterthur, Switzerland, the leading particulars of which are as follows :—

Type	4S60
B.H.P.	1,500
R.P.M.	125
Diameter of cylinder	600 mm.
Length of stroke	1,060 mm.
Overall length	10,785 mm.
,, width	2,770 mm.
Height (from the center of the crankshaft to the top of the cylinder cover) ..	5,418 mm.

The injection air compressor, scavenging air pump, fuel pump, lubricating oil pump, lubricating oil pump for crosshead pin, piston cooling water pump and bilge pump, are directly coupled to the main engine. One of the two electric-driven centrifugal cooling water pumps delivers 17.8 cub. meters of sea water per hour for piston cooling, and the other 65 cub. meters for jacket cooling. One spare pump for lubricating oil of a capacity of 12 cub. meters per hour is also motor driven.

The compressed air for starting-up is stored at a pressure of 70 atms. in six air bottles, each of which has a capacity of 800 litres. In addition, there is one tank of five cubic meter capacity, in which the pressure is 30 atms.

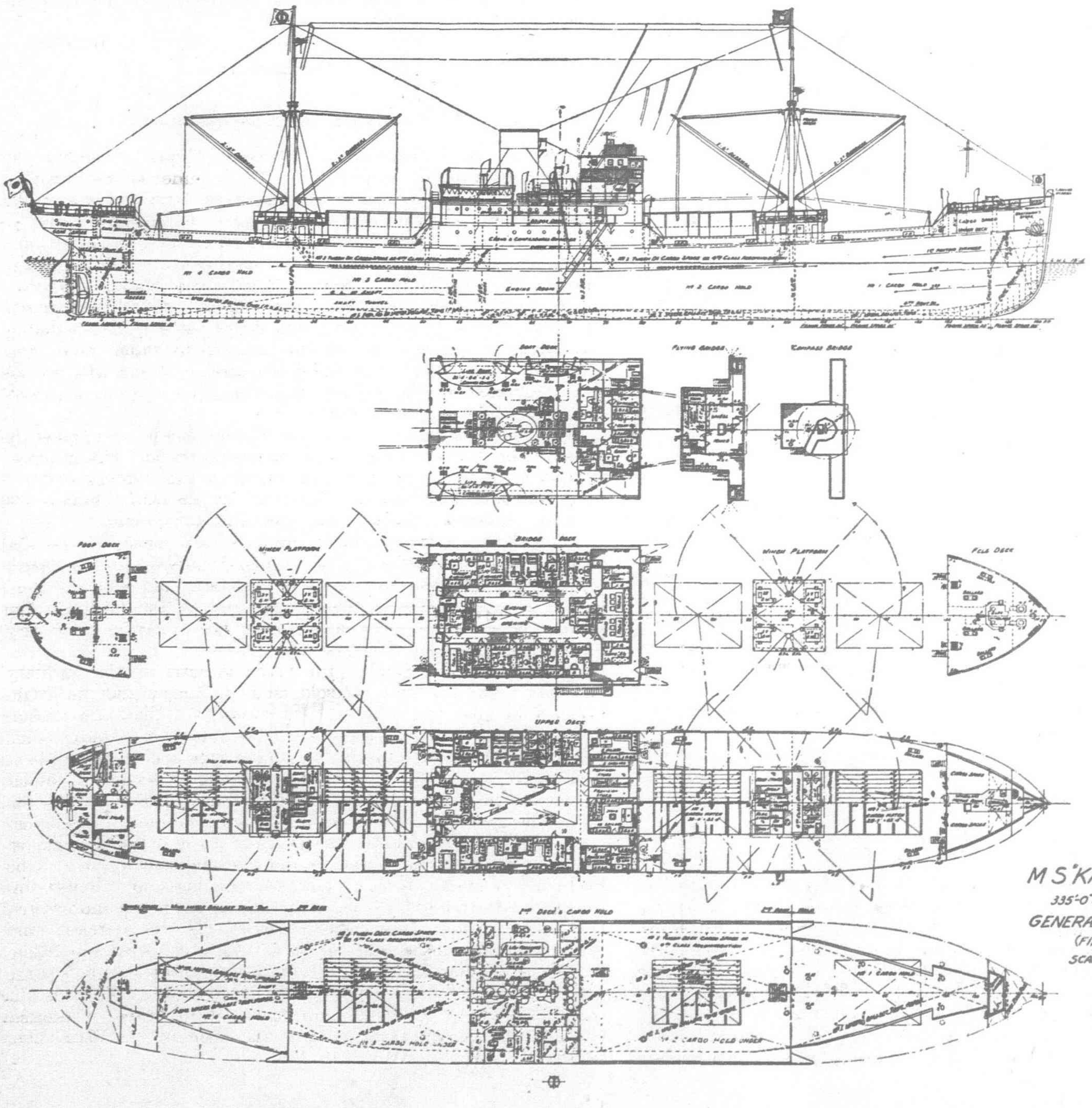
Auxiliary Machinery

The electric current for use throughout the ship is provided by three dynamos each of a capacity of 65 kw., at 225 volts, which are directly coupled to three Sulzer two-stroke cycle airless-injection engines, and two Sulzer two stage auxiliary air compressors are driven by two of these engines with friction clutch. In addition there is a two-stage emergency air compressor direct coupled to a 3.5 kw. dynamo drive by a hot-bulb heavy oil engine.

For heating and auxiliary purposes, a vertical type of boiler is installed in the engine room of a diameter of 1,210 mm. and 3,000 mm. in height, working at a pressure of 100 lb. per sq. inch, fitted with one feed water pump, one feed water filter and oil burning arrangement.

Other auxiliary machinery (all electrically driven) in the engine room are as follows :—

One fuel-oil transfer pump	(cogwheel type),	capacity	15 cm.m./hr.
One fuel-oil service pump	(,, ,,),	,,	1.5 ,,
One bilge pump	(piston type)	,,	70 tons/hr.
One ballast pump	(,, ,,)	,,	150 ,,
One fresh water and sanitary pump	(piston type),	,,	2x15 ,,
One lubricating oil purifier	(Sharples type)	,,	250 gallons/hr.
One fuel-oil purifier	(,, ,,)	,,	250 ,,



SHIP NO. 490 "KANAN MARU"
SUMMARY OF SEA TRIAL RESULTS

PLACE			JEE MIYE NAGASAKI			
DATE OF TRIAL		MAY 14TH 1931	MAY 18TH 1931			
KIND OF TRIAL		OFFICIAL TRIAL	FUEL CONSUMPTION MEASURING & PROGRESSIVE TRIAL			
DRAUGHT	FORE	6'-0 1/4"	6'-0 3/16"			
	ATT	13'-0 1/16"	13'-0 3/16"			
	MEAN	9'-6 15/32"	9'-6 15/32"			
TRIM BY THE STERN		7'-0 7/16"	7'-0 9/16"			
DISPLACEMENT (IN TONS)		3,000	3,000			
WEATHER		FINE	CLOUDY			
CONDITION OF SEA		SMOOTH	SMOOTH	SLIGHT		
DIRECTION & FORCE OF WIND		SSE-2	NW-2	NW-3	NW-4	NW-4
KIND OF LOAD		4/4	4/4	3/4	1/2	1/4
SHIP SPEED KNOT		12.686	12.601	11.752	10.557	7.942
SLIP %		-1.7	-1.7	-2.4	-4.1	-3.1
ENGINE SPEED R.P.M.		131.0	130.2	120.5	106.5	80.7
MEAN INDICATED PRESS Kg/cm²		5.42	5.35	4.60	3.82	2.39
I. H. P.		1891	1854	1476	1083	514
B. H. P.		1503	1474	1142	786	273
CONTROL INDEX	FUEL VALVE	6.9	7.0	5.8	4.0	1.7
	FUEL PUMP	5.85	5.88	5.22	4.60	3.93
	INJECTION AIR	1.0	1.3	1.8	2.1	2.0
PRESSURE Kg/cm²	SCAVENGING AIR	0.110	0.116	0.100	0.073	0.033
	INJECTION AIR	70.5	70.0	60.0	55.0	50.0
	LUBRICATING OIL BEARING	0.74	0.48	0.69	0.75	0.75
	LUBRICATING OIL CROSSHEAD	20.5	20.3	20.3	20.7	20.3
	COOLING WATER PISTON (SEA WATER)	2.68	2.52	2.52	2.50	2.60
	COOLING WATER CYLINDER (SEA WATER)	0.75	0.90	0.81	0.75	0.78
EXHAUST GAS	PRESSURE M/M.G.	170	180	127	80	50
	TEMPERATURE C°	224	225	197	150	101
TEMPERATURE C°	PISTON COOLING INLET	18.0	18.0	18.0	18.0	18.0
	PISTON COOLING OUTLET	40.3	40.3	39.1	37.3	32.5
	JACKET COOLING INLET	22.3	22.0	21.6	21.5	20.8
	JACKET COOLING OUTLET	31.0	31.0	31.3	32.3	27.8
	ROOM	22.7	19.2	20.0	20.8	20.7
DYNAMO OUTPUT K.W.		23.7	21.9	18.9	19.3	19.1
JACKET C.W. PUMP K.W.		10.2	7.0	7.3	7.5	7.3

Trials

The official trials of this ship were conducted off Miye, near Nagasaki, on May 14 and 18, and the working condition of all parts was eminently satisfactory, and there was a singular absence of vibration.

Development of Power Signaling and Interlocking on the Japanese Government Railways

(Continued from page 514).

block instruments are provided with the change over switch operated by the key which is attached to the temporary signal lever, and is taken out only in case the signal is reversed. These are illustrated in Fig. 23.

Automatic Block System on Single Track.—On single track sections as a rule, there are no plans yet for the automatic block system, but on the special single track section, such as the temporary single track operation for engineering purposes, traffic levers are used at both ends to control the intermediate signals. Again, from a single cabin, signals and switches are controlled in any traffic direction by means of an interlocking remote control system. A good example of this is found in the safety equipment temporarily installed at the Osaka-yama tunnel in the single track operation. Fig. 24 shows its locking sheet.

Highway Crossing Protection

Classes of Highway Crossings.—In our Government railways, highway crossings are divided into three classes chiefly according to volume of transportation. The first class refers to crossings where traffic is busiest. This is not only guarded by a watchman both day and night, but is provided with a crossing gate. The second class comes next as graded by volume of traffic. Here the crossing gate is provided, but the watchman is on duty at fixed hours. The third class includes all the crossings outside first and second, and there is neither crossing gate nor watchman.

Installation of Signals.—In highway crossings of the first class watchmen are stationed who keep constant watch both day and night, guarding the public against the approach of trains, and therefore no provision is made for automatic highway crossing signals except in special cases. In the second class, there is a watchman during the daytime, but at night he leaves, and there being a danger many automatic highway signals are provided. In the highway crossing of the third class where traffic grows larger and busier every day, and where there is a necessity of keeping a watchman, signals have been installed to ensure safety of transportation. (Photo No. 14)

Description of Signals.—All the automatic crossing signals now used are of d.c. flashlight type, consisting of an alarm bell and two flashing lights. The bell is worked by 8-volts d.c. and the lamp is of 10-volts and 20 watts. The automatic crossing signals installed recently are of home make. The control of the signal may be effected either by rail contacts or by track circuits, but the rail contact system is unreliable in its operation and troublesome in its maintenance so that except in the case of unavoidable necessity the track circuit system is employed.

Power Sources.—As mentioned above, highway crossing signals are generally operated by direct current. Soda cells or gravity cells are adopted for the track circuit, while the direct current is rectified by a rectifier for the line circuits. In places where traffic is congested, the lamps are supplied with a.c. which is transferred to d.c. source by means of a change over relay when a.c. is not available. For the rectifying purpose, the balkite cell rectifier and the union copper oxide rectifier are used.

Oil Lamps in Manchuria

The British Department of Overseas Trade circulates the following information furnished by the Commercial Secretary at Harbin :—In 1929 oil lamps and lanterns were imported into China (including Manchuria) to the value of 1,636,893 taels, or approximately £217,000. Of this total Manchuria imported only 172,461 taels worth, of which 124,857 taels worth entered through Dairen. Of the Dairen imports : 76,367 taels worth were from Japan, 21,415 taels worth were from abroad, 26,291 taels worth were from China. Taking the China figures as a whole (including Manchuria) almost exactly half the imports (in value) were from Germany. This is far from being the case in Manchuria, as the Dairen figures show, though they cannot be taken as giving accurately the countries of manufacture.

In South Manchuria almost the whole demand is supplied by Japan. For North Manchuria an approximate but well-informed calculation of the percentages (in value) of the various kinds of lamp-ware sold is as follows : Japanese, 32 per cent ; Chinese, 30 per cent ; American, 24 per cent ; German, 14 per cent.

The Japanese and Chinese produce very cheap lamps and lanterns which are naturally of a quality inferior to the dearer article imported from America and Germany, but which is good enough to supply between them 60 per cent of the demand. The German prices are slightly higher than the American, and very much higher than the Japanese and Chinese.

The Germans imported principally lanterns of the ordinary hurricane type, and these are sold retail in Harbin and the neighborhood for gold yen 1.15 each, or about 2s. They also market a larger lantern at gold yen 1.45. The American lantern, which is between these two sizes and of similar type and quality sells at about gold yen 1.20. The Chinese imported lanterns, similar to the smaller German type in appearance, sells for gold yen 0.85. The great bulk of the demand is for a lantern of the smaller type, and Germany is able to meet a fair share of the demand because she produces an attractive and durable article which, if the difference in quality is taken into account does not compare unfavorably with the price of the much inferior lanterns manufactured in China. It should also be remembered that the Germans were the first in the market and enjoys a long established reputation. For lamps the demand is mainly for a very cheap lowgrade lamp, and it is largely supplied by local manufacture. Many of the poorer people have reverted to burning native oils instead of kerosene owing to the present high price of the latter in the local silver currency.

Petter Oil Engines Have Many Uses

MESSRS. Petters Ltd. of Yeovil have recently delivered to the order of Messrs. Guthrie & Co., London for destination to Port Swettenham, F.M.S., a very compact type of portable oil power plant, which is intended to operate a gravel pump by belt drive.

The plant is to be used in the early stages of mine development and during this process it has to be frequently moved from one position to another.

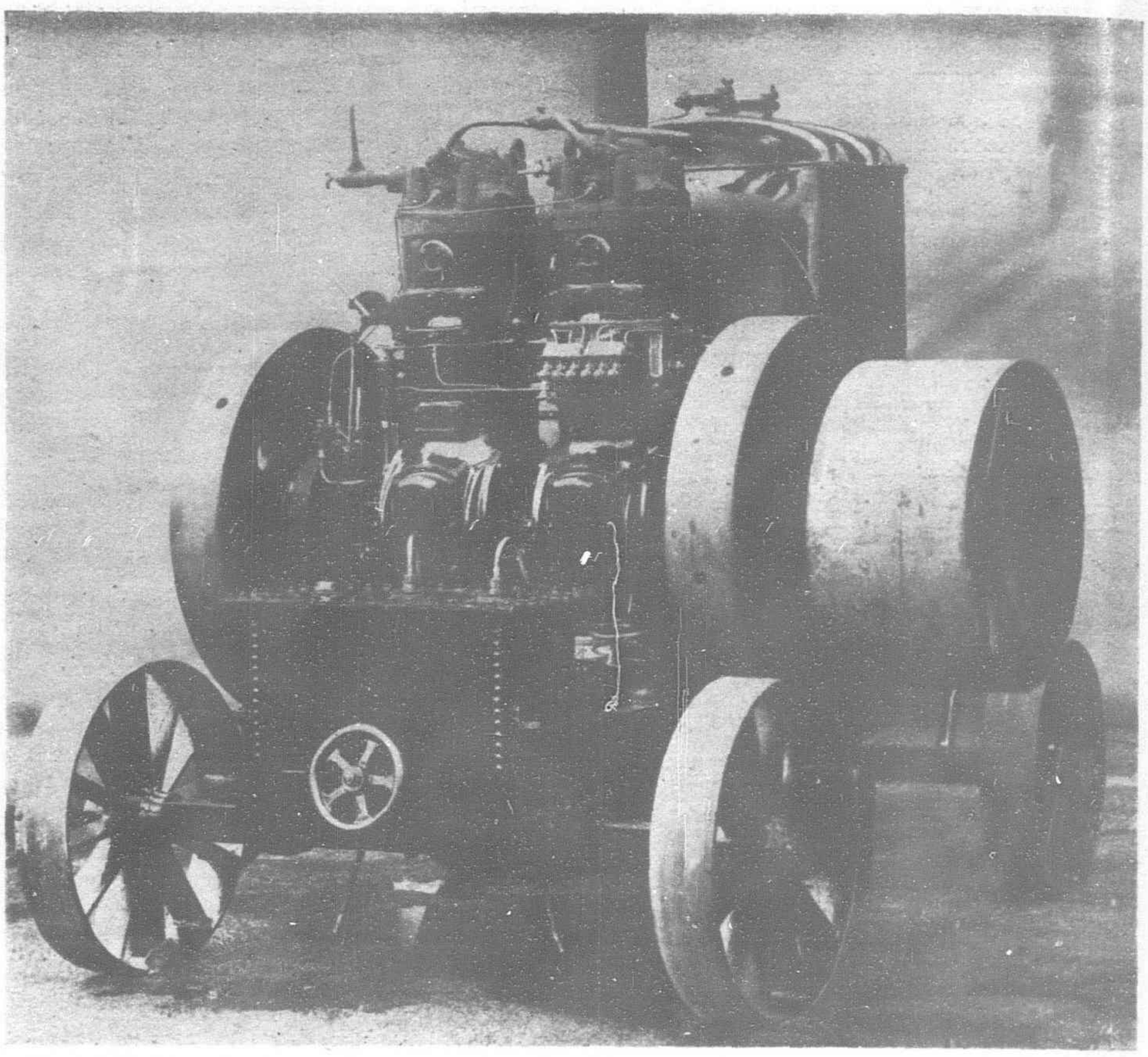
The plant consists of a Petter twin cylinder 36 b.h.p. "S" type engine, having two specially designed flywheels, to one of which is bolted a belt pulley 30 inches diameter by 15 inches wide. The speed of the engine is 450 r.p.m. A fuel tank of ample capacity is supplied, together with hand operated air compressor, air receiver, starting valve and connections.

The engine is of the cold starting type, being fitted with the Petter patent cold starter, enabling it to start up at a moment's notice on the same crude fuel oil that is used for operating purposes.

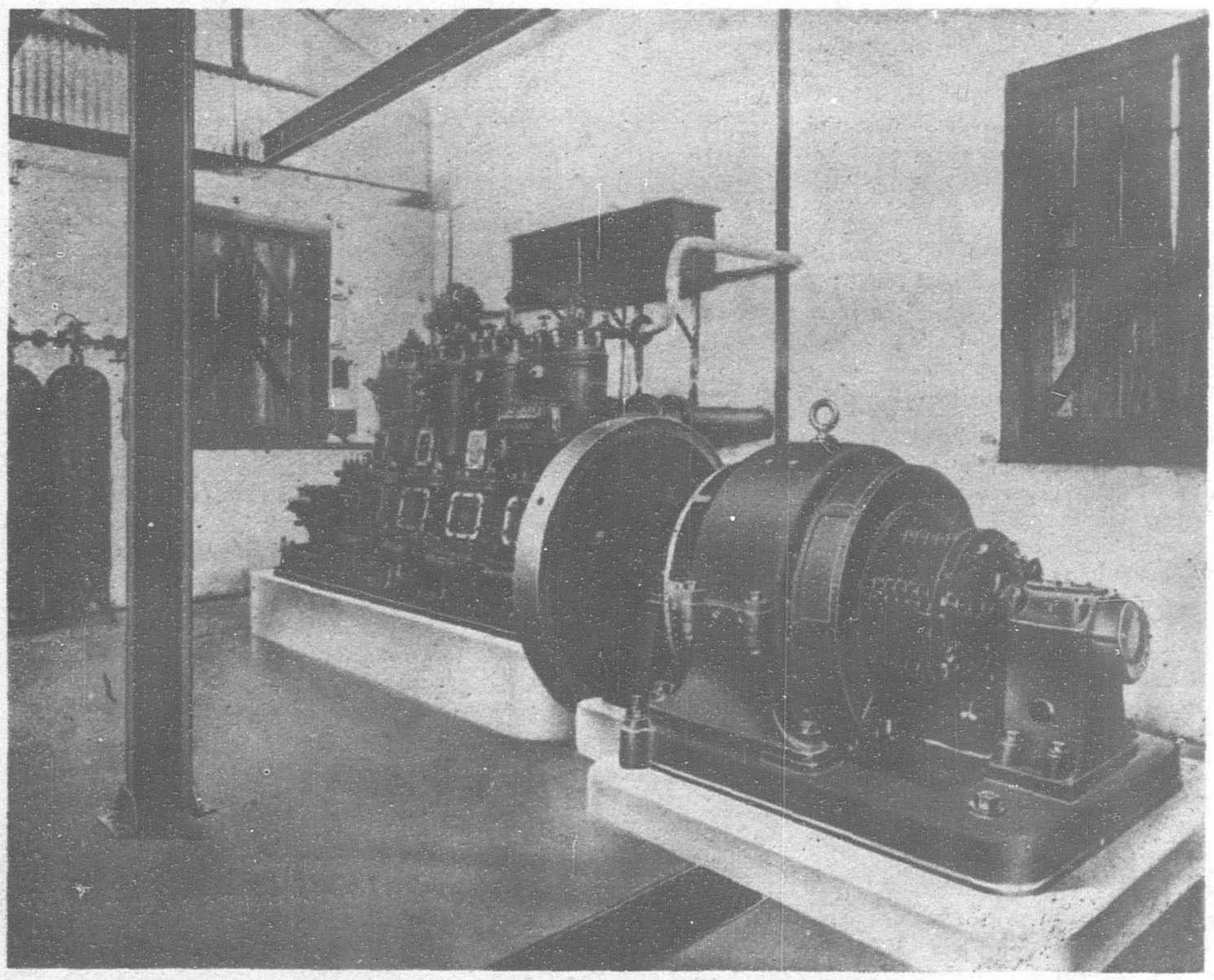
A special tropical fan-cooled radiator forms the engine water cooling system, together with a centrifugal type circulating water pump, both fan and pump being belt driven from the engine.

The outfit is provided with a tool box and tool kit, and is mounted on a strongly constructed girder frame carriage, powerful screw brake gear being fitted on the rear wheels, and pole for two-horse attachment.

Another instance of the wide uses of the Petter oil engines is shown in the illustration of a plant generating electric current for light and power at an amusement ground at Jalan Besar, Singapore. This pleasure resort is one of the most popular in the East, being visited daily by three or four thousand natives.



Petter twin cylinder 36 b.h.p. Surface Ignition engine with two specially designed flywheels, to one of which is bolted a belt pulley 30-in diameter by 15-in. wide, supplied to the order of Messrs. Guthrie & Co., for Port Swettenham, F.M.S. to operate a gravel pump by belt drive



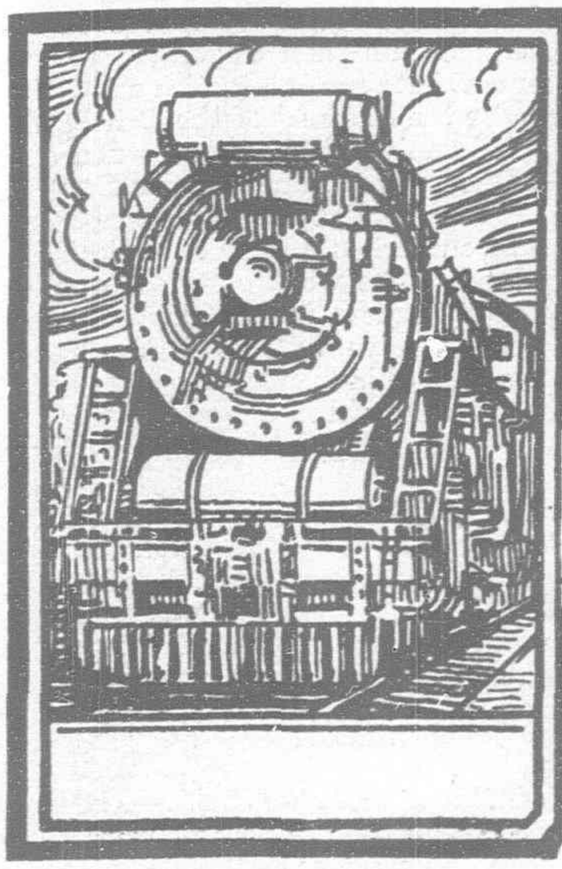
100 b.h.p. Four-cylinder Petter Atomic Diesel, two-stroke, heavy oil engine directly coupled to Compound Lancashire Company dynamo 69 k.w. 115 volts. This plant generates light and power for popular amusement ground, Jalan Besar, Singapore

The plant consists of a 100 b.h.p. four cylinder Petter Atomic Diesel two-stroke heavy-oil engine directly coupled to compound wound Lancashire Dynamo of 69 kw. output, 115 volts E.M.F.

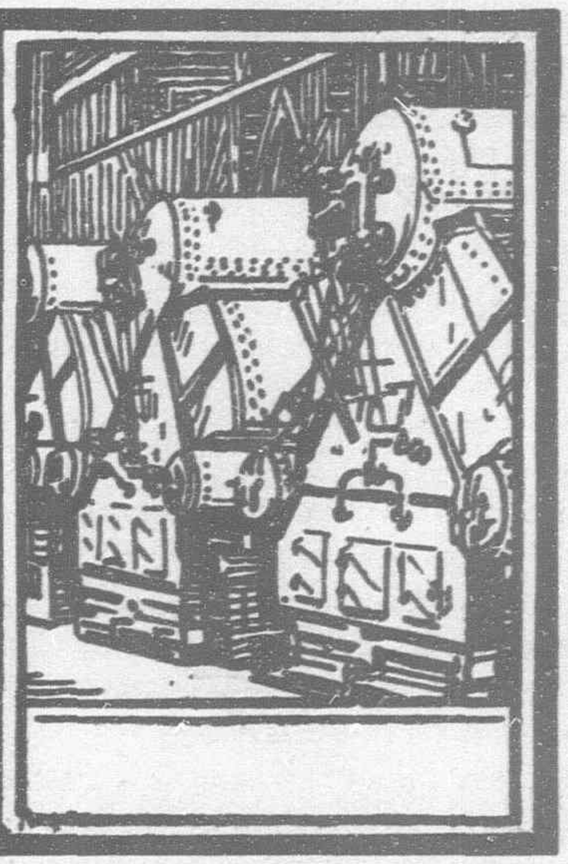
The plant was chosen for its qualities of dependability coupled with economy of performance. The attendant requires no preliminary time for starting up nor need he wait a moment after the engine has been shut down. All standby charges are therefore avoided. Regularity of running unapproached by the four stroke engine is ensured with moderate flywheel weight and the plant is so thoroughly governed and controlled that it can safely be left in operation whilst entirely unattended during long periods.

The layout of the plant is particularly neat and compact. The fuel service tank is shown in the background supported by wall brackets. Alongside of this tank to the left is a small electric motor utilized to drive the air compressor immediately below should the charging air bottles require replenishing before the engine has been started. As shown the compressor is also belt driven from the engine shaft with fast and loose pulleys.

The general appearance of the installation is highly creditable to all concerned, amongst whom the firm of Messrs. Guthrie & Co., Ltd., East India Merchants, London, Messrs. Petters' agents in Malaya, should be included.



ENGINEERING NOTES



INDUSTRIAL

Mr. Wang Kuo-chen, former director of the Hanyang Iron Works, has announced that a plant to manufacture corrugated iron sheeting for building purposes shortly will be established in Shanghai. The plant will be capitalized at $300,000, it was stated. At present China imports annually about 600,000 piculs of sheeting, principally from Japan, England, Germany and America. According to Mr. Wang's plans the local works should be able to produce at least 200,000 piculs of corrugated iron sheeting during the first year of its operation, which will enable China to curtail its imports to a considerable extent.

NEW SOVIET INDUSTRIES.—The Supreme New Council at Moscow has announced that during the first half of the current year, 183 new factories, mills, mines and departments were put into operation, costing 700,000,000 roubles. The total investment in industry establishments during the same six months amounted to 1,100,000,000 roubles. During the whole of last year the capital investment in industry amounted to 1,450,000,000 roubles.

SUBSIDY IS SOUGHT.—President Nakagawa of the Furukawa Mining Company on July 22 called on the Commerce Minister to sound the attitude of the Tokyo Government on the question of subsidizing a new aluminium company which Mr. Nakagawa is now planning to start. The new venture proposes to produce 4,000 tons annually at first and on and after the fifth year to increase the amount to 12,000 tons, using bauxilte as material. It will be capitalized at Y.30,000,000, depending on its own motive power, or at Y.12,000,000 if buying the motive power elsewhere. President Nakagawa asked for a subsidy of Y.5,000,000 in six annual instalments. The Government is in hearty accord with the proposal both from the points of encouraging industry and of military requirements, but the question of the subsidy has so far been keeping the authorities from expressing their definite attitude on the question. It appears unlikely that any subsidy will be forthcoming at present. Japan imports annually about 12,000 tons of the metal at the rate of about Y.800 a ton.

STEEL IN CHINA.—A party of German engineers is sailing for China to carry out preliminary survey work for the Nanking Government in connection with the establishment of a large new steel plant at Pukow. The proposed plant is to turn out rails and structural steel and will have an annual output capacity of 150,000 tons. The entire scheme is estimated to involve an outlay of £8,000,000, part of which is for the construction of a new railway to link up the plant with the existing railway system. Improvements at the iron ore mines in the Yangtze Valley will also be carried out.

COMPETING WITH JAPAN.—An arrangement has been concluded between Courtaulds, Ltd., the Bradford Dyers' Association, and a group of Lancashire textile manufacturers, which will enable rayon fabrics to be produced and shipped to the Far East to compete with Japanese cloths. Courtaulds will supply the yarn, which will be made into standard cloths. The Bradford Dyers' Association will then dye them and export them to India and China. All costs are to be cut.

It is open to any British manufacturer to take advantage of this scheme and thus obtain the benefit of the trade reputation of Courtaulds and the B.D.A. Some twenty or thirty firms have already intimated their intention of shipping goods under the plan.

OPENS 'PHONE SERVICE.—The Hongkong-Canton long distance telephone service will be opened for public use by the end of August, according to an announcement made by the China Electric Company on behalf of the Canton Municipal Government. In accordance with the terms of the contract made between the Canton municipal authorities and the China Electric Company, the latter is to finance the enterprise as well as to take up the engineering work on behalf of the former in return for payment of eight per cent monthly interest. The amount required for this investment is $700,000. As soon as the line is opened to public use the company will administer the service till the loan contract is settled. On the Hongkong side, from Hongkong to Shun-chun, the work is to be undertaken by the Hongkong Telephone Company. At present 80 per cent of the work has been finished. By the end of August the whole line will be ready for public service. Hongkong and Canton will be able to carry on a conversation at a charge of $2.

SOVIET RUBBER INDUSTRY.—The rubber bearing plant "tau-sagis" discovered in Kazakstan has been found to contain between 15 and 35 per cent of rubber. The root which has a length of 8 meters yields from 16 per cent to 21 per cent of rubber. Rubber is obtained from the plant mechanically without subjecting it to chemical treatment. Apart from tau-sagis the Soviet Union cultivates also a number of other rubber bearing plants including guayulla, hondrilla, kondyr, cikomia, etc. Hondrilla is planted on many millions of hectares in Kazakstan and the Ukraine. As regards guayulla, already this year 10,000,000 grafts have been prepared for the production of rubber. This year it is intended to work over also about 5,000 tons of kendyr leaves. The number of cikomia trees will be brought up to 200,000. Twenty-one thousand hectares have been planted this year to rubber bearing plants, chiefly "tau-sagis." All the rubber plantations in the country are controlled by the "Mautchukonos" Trust which has already created six State rubber farms including three in Kazakstan, and one each in Turkmenistan, Transcaucasia and Ukraine. Two special research institutes to deal with rubber problems have also been created.

MERGER IN JAPAN.—In view of the growing importance of the motor-car manufacturing industry in Japan, the government committee concerned has been conducting investigations with a view to developing the industry from the standpoint of business and national defence. In the circumstances, a plan for the inauguration of a new motor-car manufacturing company is under contemplation, aiming at the amalgamation of the three big motor car manufacturers, namely the Ishikawajima Motor Car Company, Tokyo Gas and Electric Engineering Company and Tobata Steel Works. The new motor car manufacturing company will be established with the estimated capital of Y.10,000,000.

AMERICAN EXPORTS TO RUSSIA.—American exports of metal-working machinery to the Soviet Union during 1930 amounted to $14,337,812 or over one-third of the total exports of such equipment, according to a report of the U.S. Department of Commerce published in *Commerce Reports* of July 6. In the previous year the shipments to the U.S.S.R. totaled $2,671,621, showing a gain of 438 per cent during 1930. The Soviet Union led all takers of such equipment, replacing Canada and the United Kingdom. Total United States exports of metal-working machinery last year were valued at $41,945,398, or 3 per cent above those of the year before. This record was due to the unprecedented total of exports to the Soviet Union, since other important markets were greatly depressed. Shipments to Europe totaled over $30,000,000, gaining 20 per cent, and were nearly three-fourths of the total, also as a result of Soviet purchases.

SHIPPING AND SHIPBUILDING

SHANGHAI GROWING.—Shanghai is claiming to be growing rapidly towards one of the really great ports of the world, states a Shanghai (Reuter) message. In 1929, the latest year for which full returns are available 35,869,560 tons of shipping entered and cleared the port. Only seven years peviously New York stood out as the greatest port in the world with only 2,000,000 tons more than Shanghai's 1929 figures. At that time Shanghai was fifteenth among world ports with only just over 15,000,000 tons. Thus Shanghai's tonnage has more than doubled in seven years.

BUYS NEW SHIPS.—Under the name of the Portland California Steamship Co., the Dollar Steamship Lines purchased the twenty-two vessels comprising the former fleet operated in the Gulf and Intercoastal Trade by the Trans-Marine Lines. The fleet was operated by the Trans-Marine Lines from 1924 to 1929. Nothing definite has been decided as to what use will be made of the vessels but it has been intimated that possibly six of them will be used in the coastwise fleet of the Admiral Line and the balance in the Trans-Pacific trade.

JAPANESE SHIPPING.—The accounts of Nippon Yusen Kaisha (Japan Mail Steamship Company) for the half-year ended 31st March show a loss of 644,068 yen, compared with a net profit of 412,663 yen for the corresponding period to March 31, 1930. The loss is struck after providing 4,540,504 yen for depreciation of the fleet and buildings, 1,127,026 yen for ships' structural repair fund, and 70,681 yen for insurance fund. After crediting 1,183,437 yen brought in a sum of 539,368 yen is carried forward. For the corresponding half-year a dividend at the rate of 5 per cent. per annum was paid. The balance-sheet shows the reduced book value of the fleet at 118,125,477 yen, as against 91,198,346 yen. As announced in *The Financial Times* of April 7, a ten-year agreement between the company and the Osaka Slosen Kaisha has been concluded. Together the companies control more than 260 steamers.

CHINESE SHIPPING AGREEMENT.—A report on the trade situation at Shanghai, published by the Department of Overseas Trade, states that, with a view to the limitation of competition, the six leading companies operating steamship services on the Yangtse river (two British, one Japanese, and three Chinese) have concluded an agreement for the enforcement of uniform freight rates and the discontinuance of the system of secret rate-cutting. It is understood that arrangements for the pooling and *pro rata* distribution of freights are also under consideration. As the first result of this agreement, freight schedules have been increased by 15 per cent. and are to remain in force for one year.

RUSSIAN TIME-CHARTER TERMS.—The British Trade Journal and Export World reports that while shipbuilders are not opposed to the proposals to extend Government credits to Soviet Russia for the building in this country of more shipping, shipowners, in view of the huge supplies of idle tonnage and the lowness of freights, are naturally firmly against such a scheme. The Baltic and International Maritime Conference, whose headquarters are at Copenhagen, states that it has made representations to the British Government against the grant of such credit facilities, and that these representations were based on a resolution passed at a meeting of the directors recently held in Brussels. The Conference writes that in other countries Governments and other parties are watching developments in Great Britain, and that the granting of the facilities desired, or even a favourable sign to that effect, would be taken as a signal for other countries whose shipbuilding is in a like depressed condition to embark on similar schemes.

SOVIET SPEEDS BUILDING.—A Soviet Government commission has arrived in Copenhagen to investigate the possibility of purchasing fast and up-to-date vessels for one of the most important phases of the Five Years' Plan. The commission consists of V. J. Soff, Commissar fgr the Soviet Mercantile Marine; M. Logonofski, representing the Department of Foreign Trade; and M. Solakoff, president of an import company, together with commercial and marine experts. Russian shipyards are now working to their utmost capacity in the construction of new vessels, but the Five Years' Plan demands at greater output still, it is stated. All the principal Danish yards are to be visited. Only large, fast and wholly up-to-date craft will be considered, and motor ships will be chosen in preference to other types. A large number of Diesel engines are also to be purchased. These will be installed in the ships now nearing completion in the Russian yards.

AVIATION

NANKING BUYS PLANES.—A squad of six pursuit planes recently ordered from Germany by the Aviation Administration of the Ministry of War flew to the Capital from Shanghai where they had been assembled. It is understood that the machines will be despatched to the front to participate in the bandit-suppression campaign in Kiangsi.

JAPAN'S NEW AIRPORT.—The newly-constructed international airport at Haneda, on the outskirts of Tokyo, which is to be opened in August, it is claimed is the largest and best of its kind in the Orient. It extends over 130 acres and is equipped, among other things, with a post office and a branch of the Central Meteorological Observatory. The airport will be placed at the disposed of foreign aviators instead of Tachikawa aerodrome, which will in future be retained as a military airfield.

NEW SOVIET AIR LINE.—The United Civil Aviation Industry has decided to open the Moscow—Irkutsk—Vladivostok air-line this August. The line, which will be about 10,000 kilometers in length, will be the longest in the Soviet Union and one of the longest in the world.

NEW AIR ROUTES.—It is learned at the Nanking Ministry of Communications that preparations are being made by the China National Aviation Corporation to operate in the near future air services linking up the North-western provinces with other parts of the country. Plans and charts for a Ninghsia-Hankow and a Lanchow-Harbin air mail and passenger service have been submitted to the Executive Yuan and approved. The Corporation has been instructed to dispatch deputies to make surveys of the air routes to be traversed by the two air lines proposed.—*Kuo Min.*

JAPAN HAS 623 WAR PLANES.—The Japanese War Office has published figures on the nation's military strength which will be submitted to the League of Nations in connection with the 1932 disarmament conference. These figures showed the army numbered 231,600 men, including officers, in addition to 2,210 men in the gendarmerie and about 20,000 police in Korea, Formosa and Manchuria. The aviation branch totaled 623 airplanes and eight regiments. It was intimated these figures would be increased.

CHINA BUYS GERMAN PLANES.—In order to train competent aviators for military purposes, the Nanking Aviation Department of the Ministry of War has ordered 20 pursuit airplanes from the German Junkers Company. Each of the planes is said to cost G.$25,000. According to arrangements made, shipments will begin from the latter part of this month. It is understood that every ocean liner which arrives at Shanghai from Germany after July 20 will have a shipment on board. Training of the aviation students under a German instructor will commence as soon as machines reach the Capital.—*Kuo Min.*

OPENS NEW SERVICE.—Passenger service between Shanghai and Manchuli and intermediate points was being planned to open August 1 with the Eurasia airplanes. The table of fares is as follows: Shanghai to Nanking, $50; Shanghai to Tsinan, $165; Shanghai to Peiping, $250; Shanghai to Linsi, $400; Shanghai to Manchuli, $515. It is reported that the missing Eurasia Plane No. 2 recently detained in Outer Mongolia has been located. One of the two captured German pilots was wounded and is now undergoing treatment in a Mongolian hospital; the other is still under detention, the report states.—*Kvo Min.*

RAILWAYS

TO PLACE BIG ORDER.—With increasing traffic on the Shenyang-Hailun Railway, in Manchuria, a large order for railway rolling-stock will be placed shortly to cope with the heavy requirements for goods and passenger accommodation. A total of 50 freight coaches, 30 baggage and sleeping cars, and four locomotives for passenger trains will be ordered. Negotiations have been under way with the Japanese South Manchurian Railway workshop for this equipment, the total value of which exceeds three million dollars, but the order has not yet been definitely placed. Bids are now likely to be called from manufacturers of other countries.

RAILWAY MATERIAL FOR CHINA.—The Purchasing Commission appointed to carry out the agreement between the British and Chinese Governments for the disposal of the British share of the China Indemnity of 1901 has opened offices at 21 Tothill Street, Westminster, with Dr. Ching Chun Wang as director. £3,500,000 is to be used for purchasing materials in Great Britain and Northern Ireland. The work of the Commission will be to execute orders from China. The first order has been received. This is for railway materials of various kinds, ranging from shovels to locomotives, to the value of about £300,000.

RAILWAY RECEIPTS.—Shenyang, August 9.—The gross receipts of the various railways in the North-eastern provinces for the month of July total $3,200,000, the North-eastern Communications Committee announces. The Peiping-Liaoning Railway alone showed a revenue of $1,500,000. —*Kuo Min.*

LOCOMOTIVES FOR SOVIET.—The Soviet Trade Delegation in Great Britain placed an order on May 27 with Messrs. Marshall & Sons, Ltd. for 175 portable locomotives for the lumber industry. The value of the order is about 100,000 pounds sterling ($500,000) and extended credit terms are being provided for. The entire order is scheduled to be completed and delivered by next September. An engineer of the British firm is to go to the U.S.S.R. for a period of a year to assist in the work of the erection and operation of these machines.

RAILLESS CARS IN TOKYO.—The Tokyo Municipal Electrical Bureau has decided to proceed with its scheme for the operation of a railless-car service in Tokyo. Six cars will be employed initially and if the results are satisfactory this number will be increased. The Susuki route is to be equipped first and a service is expected to be put into operation in the course of the current fiscal year.

NEW TRANS-SIBERIAN RAILWAY.—It is expected that plans for the so-called Great Northern Route will be pushed in a fairly near future. The great Northern Route would be a railroad connecting Leningrad with Eastern Siberia, but following a more northern course than the existing Trans-Siberian Railroad. Advocates of the project argue that as Siberia develops it will need another long-distance railroad and that the Great Northern Route would open up a region rich in lumber, minerals and furs.

BUYS RAILWAY EQUIPMENT.—British railway material to the value of £3,500,000 for the use of China's railways, is being bought by the purchasing committee in London, to whom the money, the proceeds of Britain's share of the Boxer Indemnity Fund, has been handed over in accordance with a recent agreement, cables *Reuter's* Nanking correspondent. The announcement was made by Mr. C. T. Wang, the Foreign Minister, in the course of a statement to the Press.

ELECTRIC RAILWAY EXTENSIONS.—The Jobu Electric Railway has applied for sanction to start work on the extension of its electric railway system for a distance of 16 km between Musashi-Kuki and Mukosakai. It is expected that the work will be completed by June, 1932. The extension of the Nunobiki Electric Railway in Nagano Prefecture for a distance of five miles is also to be carried out shortly, at a cost of over a million yen.

MINING

GOLD DEPOSITS.—A report that rich gold mines have been found in Jehol and Heilungkiang has been received at the Nanking Ministry of Industry from Mr. Wang Cheng-fu, Head of the Mining Department of the Ministry, who has been inspecting mining conditions in the North-east.

GRAPHITE DEPOSITS IN FAR EAST.—Progress has been made with the investigation of the value of the great deposits of graphite, found not long ago on the Amur, between Chabarovsk and Blagoveschtchensk. Samples on test have resulted quite satisfactorily. Concentrated ore containing 15 per cent. carbon made a high-grade crucible graphite. The content in carbon of the crucible graphite was 92-95 per cent. The reserves of these (Kureisky) graphites are estimated at 522,000,000 tons.

FINANCE AND TRADE

LOAN IS SOUGHT.—The Nanking Ministry of Communications is requesting another $3,000,000 fund for the improvement of the Shanghai-Nanking long distance telephone service, according to an announcement made by Mr. Wang Peh-chun, the minister. On account of the present financial difficulties the scheme has been delayed temporarily. In connection with the proposed shipping bonds to the amount of about $10,000,000. Mr. Wang said that unless the distribution of this loan is guaranteed the Ministry of Finance may not be in a position to issue them.

TRADE FALLS OFF.—A marked decrease is registered in Japan's trade with the Soviet in the first half of the current year, according to investigations by the Finance Office. The exports in the period under review amounted to Y.13,170,415 and imports Y.5,401,162, the excess being Y.7,769,252. Compared with the same period of the preceding year these figures represent respectively a decrease of Y.8,000,927 in exports, an increase of Y.807,818 imports and a decrease of Y.7,193,109 in total.

SIAM SELLS SILVER.—The Acting American Commercial Attaché Charles E. Brookhart, Bangkok, reports that the Siamese Government has passed an amendment to the currency act, providing for the disposal of surplus silver currency now held by the treasury. For some time past the silver bahts (baht=approximately $0.44) in circulation have been replaced gradually with paper notes, and the people now show a pronounced preference for the paper money. As a result, there has been a considerable accumulation of silver coins in the treasury, where they are practically useless, since it is not intended to reissue them.

The amendment to the currency act authorizes the Minister of Finance to dispose of this accumulated silver and to purchase gold or gold-exchange securites with the proceeds. Such an operation must be transacted carefully, in view of the sensitive nature of the world's silver market at this time. A statement issued by the Minister of Finance regarding the new act, states: The silver market is at present in a very sensitive condition and His Majesty's Government, accordingly, proposes to proceed with caution and deliberation when effecting its sales of surplus silver, so as to avoid undue perturbation in the market.

LOAN FOR TOKYO HARBOR.—In pursuance of its project for the reconstruction of Tokyo harbor at a cost of 33 million yen over a period of 10 years, the municipal authorities are going to float a loan, to cover part of the required funds, in August.

SOVIET-JAPANESE TRADE.—A proposal, advocated by the Japanese Finance Minister, to establish a credit of 100,000,000 yen (approximately £10,000,000) as a means of stimulating Japanese trade with Soviet Russia and of relieving the glut of credit lying idle in the banks at present, was discussed in Cabinet Council recently. It is understood that the Government is not favorably disposed towards the plan, which was originally brought up some months ago. Industrial leaders are urging the Government to abandon the no-loan policy and float new loans as a means to bring about an industrial revival.

BUYS JAPANESE COPPER.—Negotiations among the Suiyo-kai, the Mitsubishi Shoji and the Soviet Commercial Commissioner in Tokyo for the supply of copper ingots were concluded on July 18 on the following conditions:

1. Soviet will be supplied with copper to the extent of 500 tons a month for August, September and October; total of 1,500 tons.

The price will be slightly higher than the average c.i.f. London price for each month.

3. Bills will be drawn at six months sight.

After the expiration of the three months, the supply is likely to be continued by renewal of another three-month contract.

COMMUNICATIONS

DIRECT RADIO SERVICE.—Preparations for the inauguration of a direct radio service between China and England are being made by the Government International Radio Station, it is learned. The Ministry of Communications is understood to have entered into negotiations with the British authorities for a working arrangement. Two short-wave radio stations were recently installed at Amoy and Foochow to cope with increasing demands and to facilitate traffic with Shanghai especially.—*Kuo Min.*

ATTEND COPENHAGEN CONFERENCE.—A strong Japanese radio delegation—a national group of thirty-three attended the Copenhagen International Radio Conference. Its six members include Toyokichi Nakagasi, radio chief of the Imperial Department of Communications, and Yutaka Itow, chief engineer of the Broadcasting Corporation of Japan, both of whom stressed in interviews the value of the conference in furthering raido technique. Mr. Nakagasi said that there now were nearly a million listeners in Japan and that six new stations were being erected. This will bring the number in Japan and colonies to seventeen, of which eight are of ten kilowatts.